D R A F T

TWENTY YEARS OF IDRC PROJECT SUPPORT
in
THE CENTRAL ANDES
of
PERU AND BOLIVIA

Evaluation Report prepared for the

Evaluation Unit and Minga PI
International Development Research Centre

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Executive Summary

This report discusses the collective impact and influence of a selected set of more than thirty IDRC supported projects (see Annex 2) carried out by researchers and research organizations in Southern Peru and Bolivia beginning in the late 1970s. The main focus is on the processes of introduction, development and evolution of a more holistic "systems" approach to understanding and improving agricultural production and sustainable natural resource management (NRM) in a highly variable and difficult natural environment. It deals with many actors from different backgrounds, training, interests and objectives and the alliances they formed to work toward common objectives. The study documents opportunities created and evidence of the impact these projects have had on individuals, communities, organizations, education programs related to agriculture and NRM, and contributions to systems thinking in the larger research community of the two Countries. It is the story of how attempts to apply a modern Western science paradigm to increase productivity in a traditional, highly complex and culturally integrated, agricultural production system were played out.

From an Andean perspective, the IDRC projects constitute influential “inserts” in a long term continuous process of change rather than discrete, self contained activities oriented only toward specific objectives and outputs. At least three different cultures, or perspectives, came together in the set of projects examined. First, IDRC, as a relatively new “research for development” agency, seeking to contribute at the leading edge of applied research approaches linking Western scientific understanding and techniques to rural and agricultural development problems. Second, the intended beneficiaries of the project outputs, people living in traditional indigenous rural community environments of the high Andean valleys and the “*altiplano*” or high plateau of southern Peru and Bolivia. Third, the research community and organizations of Peru and Bolivia which had been influenced by North American and European research paradigms and by the flow of social and political ideas and movements in the region over the prior seventy years. The perspectives of these actors and the experience each brought to the projects had much to do with the dynamic form taken by the many alliances, initiatives, contributions and debates which ensued.

How research projects can facilitate positive change for disadvantaged rural groups raised questions, from an IDRC perspective, about the nature of the influences and impact that resulted from its initiatives. What changed when IDRC brought into the dynamic of the Andean milieu some *avant garde* ideas, for the time, about the organization of agricultural research and local participation? Who changed and in what manner? What alliances were necessary and how did they evolve?

In response to these questions, both endogenous and exogenous variables operating in participating groups and communities involved in the projects need to be considered. The former derive from conditions given by community and family needs, by the socio-historical setting and by the geophysical resource base. These three endogenous groups of variables are linked and changing and it is the dynamic of this interaction, and that inside each set of variables, that defines the starting conditions of a project. For change to take

place additional influences are generally necessary and it was external or exogenous perceptions of new opportunities for Andean rural communities that sparked the initiation of the projects spearheaded by IDRC. Among these can be included the knowledge and the set of values and concerns that IDRC brought, emerging as they did, from its own mission definition and from past experiences in other situations and countries.

New values and concerns continued to appear over time. For IDRC they involved an evolution of thinking with respect to production systems along a continuum from cropping systems and animal production systems to the more integrated farming systems research (FSR) approaches which included insights from the social as well as the biological sciences. This evolution proceeded to a further level of conceptual integration in the form of NRM. The FSR approach and methods do not disappear but continue, nested within NRM, to be applied as needed. The more inclusive concept of NRM has become sufficiently consolidated to be considered increasingly endogenous, or internalised within the Centre and its programs. In the same manner, many practises and much of the knowledge derived from the projects has been integrated with previous approaches and knowledge to become endogenous in Andean research and development organizations and rural communities.

Overall, the IDRC supported projects focused on specific topics related to valuing Andean products and knowledge with the effect of creating a development systems "school" oriented to research for development in the Andean context. It has left an intellectual heritage with styles of research and work traditions defined through in situ experimentation and, as a consequence, added to the social capital of Peru and Bolivia. If there is one definitive impact or influence, it can be summed up in the mission given the Centre at its creation and emphasized in the following set of activities: building research skills; expanding opportunities for indigenous researchers; and, contributing to the search for solutions to development problems in the researchers' own societies. All the projects examined and the views gathered from knowledgeable informants confirm that IDRC has made a substantial contribution in all aspects of this challenge.

Broad impact and benefits to identifiable groups or communities is much more difficult to define. Specific measurement of development results arising from a research project and their attribution to an individual donor agency or development organization is spinning a tenuous web. Impact at the level of a family or community, to say nothing of a whole region, is normally the result of many influences drawn together by the target population within an historical background and ecological, cultural and economic context. IDRC projects, even though purporting to take a systems or holistic approach, only dealt with a few variables and relationships at a time. Applied results depend on the interaction of many actors and influences acting at various levels. The challenge is to identify, in any given situation, those key variables and relationships which provide the strongest leverage for facilitating change.

The continuing challenges emerging from this analysis of IDRC project histories and the observations of project participants are simple to state but complex to confront. They involve: bringing together multi-faceted issues in proper context and interpretation; addressing the dynamic of change in traditional societies, not just the symptoms; keeping

the beneficiaries clearly in view, especially when working at higher levels of system organization and abstraction; and, building the linkages and relationships that determine institutionalization of important project results and experiences.

1. Introduction

1.1. Purpose

This study comprises a retrospective analysis of the collective impact and influence of a selected set of more than thirty IDRC supported projects (see Annex 2) carried out by researchers and research organizations in Southern Peru and the *altiplano* of Bolivia over a twenty plus year period beginning in the late 1970s.

The main focus is on the processes of introduction, development and evolution of a more holistic "systems" approach to understanding and improving agricultural production and natural resource management (NRM) in a highly variable and difficult natural environment. It deals with many actors from different backgrounds, training, interests and objectives and the alliances they formed to work toward common objectives. Target populations for the projects were very poor indigenous people living in traditional communities only marginally linked to the market economies of the two countries. The application of Farming Systems Research (FSR) methods is considered in this context as one attempt to apply methodologies developed to better design and test technological and organisational options for improvement of rural community and family well-being.

The study documents opportunities created and evidence of the impact these projects have had on individuals, communities, organisations, education programs related to agriculture and natural resources management (NRM), and contributions to systems thinking in the larger research community of the two Countries. It evolved out of an expressed interest by some of the participants in the projects to tell their story and analyse the changes catalysed or brought about by their activities. The idea was taken to members of the IDRC Evaluation Unit (EU) who suggested adjusting the proposal to engage a broader assessment of institutional evolution in FSR capability and in the reach and impact this has had on other institutions and farming systems in the region.

The Minga Programme Initiative (PI) was also interested from the perspective of adding to its understanding of the precursors to its present initiatives and the implications this may have for future programming. Emphasis was encouraged on the questions of:

a) what and who has changed;
b) how have they changed and how did the changes take place;
c) in what way and in what elements has IDRC contributed to the observed changes; and,
d) what alliances were formed, for what purpose and how did they function?

An important output of this report is the story of how attempts to apply a modern western science paradigm to increase the productivity of some components of a highly complex and culturally integrated system were played out. What lessons have been learned? What worked and what did not? Has there been impact and in what ways? What has been the "reach" of a series of projects both directly and through influence on other actors? What does this experience show which can inform current IDRC programming and project

support? These were the concerns we sought to examine in seeking a response to the questions posed by the Evaluation Unit and the Minga Programme Initiative of IDRC.

Some of the answers to these questions have turned out to be different from the results anticipated in the project documentation and IDRC planning documents. It has been much more difficult to determine specific impact on the beneficiary populations because of the intricate web of interactions involved in the overall change process we encountered. IDRC support went to intermediary organizations which were deeply involved in the traditional rural environment of the selected region and inevitably their perspective on the situations they studied played a strong role in forming the focus and outputs of the projects. The influence and impact of IDRC support is therefore quite evident in the researchers and the alliances they formed within and between organizations many of which were not direct recipients of IDRC support. Clear cause-effect influence is more difficult to establish in the target communities. But this is getting ahead of the story.

In the following section we set out the historical and conceptual context in which the projects were developed and brought to fruition. This is described from the perspective of the three main participants: IDRC, the traditional Andean communities of Peru and Bolivia, and the national agricultural research and development organizations. Section 3 then discusses the interplay of the many actors and forces involved in the changes surrounding the IDRC projects from the perspective of the four questions posed above.

A summary of the activities, issues, interactions, successes and difficulties encountered in the selected projects is presented in section 4. The material is drawn principally from IDRC documentation and from interviews with IDRC staff who managed the projects. In general, it presents an IDRC view of its work and expectations regarding project content, impact and relevance. This material is followed by a section of short case study descriptions of specific applied experiences illustrating several ways impact was achieved at the rural community and farm level.

In section 6, we switch to a view from the project participants and actors in situ compiled from interviews, questionnaires, focus groups and first hand observation in the areas where the work was carried out. Coverage is limited to a subset of projects which were the main focal point for IDRC agriculture support and representative of the overall set of issues, concerns and contributions. Finally, in section 7 we present a summary of the main ideas and results discussed in the report and end with some observations on research challenges for the future. For a list of the projects reviewed and their main objectives and anticipated activities, we draw your attention to Annex 2, and to Annex 3 for a more detailed explanation of the methodology and organization of the study.

2. Background

In order to trace the influence and role of IDRC supported research and development work in the Andes from 1977 to the present, it is important to first understand something of the context within which the work evolved. This commentary is intended to set the stage for the rest of the study which presents IDRC as a participant in an ongoing play of shifting interests, relationships, alliances, confrontations, learning and dynamic change. As one informant suggested, IDRC projects can be viewed as "inserts" in a continuous process of change where experience and change is being accumulated. From this perspective, projects and their results take on further-reaching implications than if viewed only as independent activities oriented toward results related to specific technical and social organization topics.

At least three different cultures came together in the set of projects being examined. First, IDRC, as a relatively new "research for development" agency, sought to participate at the leading edge of applied research approaches linking Western scientific understanding and techniques to rural and agricultural development problems. Second, the intended beneficiaries of the project outputs, people living in traditional indigenous rural communities of the high Andean valleys and the "*altiplano*" or high plateau of southern Peru and Bolivia. Third, the research community and organizations of Peru and Bolivia which represented, for the most part, an elite within their own societies who had been influenced by North American and European research paradigms and/or by a flow of social and political movements in the region over the prior seventy years. Each group brought its own experience and conceptual orientation to the many alliances, confrontations, and initiatives which ensued within the context of shifting power relationships and political scenarios. These groups, their context, and what they brought to the projects are outlined in the following text.

2.1. IDRC and a New Applied Research Paradigm

The Act of Establishment of IDRC, 1970, (International Development Research Centre 1970) set forth the purposes of the new organization in very open and inclusive terms. These are:

- to initiate, encourage, support and conduct research into the problems of the developing regions of the world and into the means of applying and adapting scientific, technical and other knowledge to the economic and social advancement of those regions, and, in carrying out those objects, to enlist the talents of natural and social scientists and technologists of Canada and other countries;
- to assist the developing regions to build up the research capabilities, the innovative skills and the institutions required to solve their problems;
- to encourage generally the co-ordination of international development research; and,
- to foster co-operation in research on development problems between the developed and developing regions for their mutual benefit.

As David Hopper, first IDRC President, observed in his address to the IDRC Board in March, 1973 (Hopper 1973), the Centre initially focused principally on the encouragement and support of research into the problems of developing regions. It adopted a strong science and technology orientation and an applied or practical research focus mutually believed to be of relevance for the economic and social advancement of the organizations and people who welcomed IDRC collaboration. He went on to note that particular emphasis was being given to clause (b). Centre support was focused on building the research skills of scientists and technologists, on expanding opportunities for indigenous research workers to build personal skills and experience and on contributions to help find solutions to development problems in their own societies.

The Centre began its existence with a strong agriculture, food and rural development effort at a time when questions were beginning to be raised about existing agriculture science and extension programs that had proved so successful in North America in the 1950s and 1960s and about the "green revolution" and its impact in developing countries. The same approaches and solutions that had been so effective under relatively ideal production conditions were failing to have much impact under traditional peasant agriculture systems in various parts of the world. Farmers managing these production systems had additional objectives and needs which were not satisfied by the single crop, high input cash crop paradigm. IDRC took up this theme by supporting researchers interested in exploring the intricacies of traditional cropping, animal production and farming systems. From the social science perspective, support was given to inquiry into the social and economic aspects of these systems and rural economy. It is worth remembering that twenty five years ago, many ideas and the tools and methodology we currently take for granted did not exist or were in various early stages of development and experimentation.

Two of the first projects supported by IDRC involved rural development in a pilot area in Colombia and studies of multiple cropping systems at IRRI and the University of the Philippines, Los Baños, in the Philippines. The background to these initiatives is well explained in the IDRC publication "Caqueza: Living Rural Development" (Zandstra, Swanberg et al. 1979) which sets out the social, economic, political, technical and scientific context within which they were conceived. The following observations draw heavily from this text.

In Colombia, as elsewhere, efforts to improve rural productivity through new agricultural technology were based on "community development" and "agricultural extension" programs. The current wisdom held that rural communities were inefficient in their use of resources and if only they could be induced to adopt better technology, livelihoods and well-being would be vastly improved. Communication and education programs were promoted to disseminate technical information and motivate farmers to become adopters. The assumption that low productivity was caused by inefficient resource use and change resistant peasants was largely derived from experiences in the developed world. That peasants did not have access to the total package of support required to take advantage of the new technologies, particularly institutional supports in terms of credit and marketing services was not perceived. U.S.A. type extension activities were strongly supported

throughout Latin America during the late 1950s and early 1960s, especially by the Interamerican Institute for Cooperation in Agriculture (IICA), but with only minor impact as indicated by a 1971 USAID evaluation study (United States of America. Agency for International Development 1971).

Some economists such as Schultz (Schultz 1964) and Hopper (Hopper 1957) however, postulated a different scenario. The small traditional peasant farmer was poor but efficient they argued. Efficient, that is, in the use of the extremely limited resources at his/her disposal and in the face of substantial risk of disastrous loss. These insights were taken up by various individuals and groups and led to the design and implementation of more comprehensive approaches in model rural development projects or RDPs. The first of these to receive wide attention was established at Borgo a Mozano in Italy and this was followed by the Comilla project in Pakistan, the Intensive Agricultural District Program in India and the Puebla Project in Mexico (Zandstra, Swanberg et al. 1979). These initiatives had their spin-offs and attracted followers which by the early 1970s had spawned considerable interest. Each model incorporated various aspects of extension and community development strategies and in its own way attempted to show how a development process could be initiated while incorporating the task of organizational change necessary to capture the potential gains promised by more productive technology.

These experiments were keenly observed by a few policy-makers and planners in a number of Latin American countries, particularly in Colombia. Some of the staff in the newly created IDRC were also aware of these initiatives and the lessons being learned, not the least being its President, David Hopper, whose Ph.D. research in India noted above had helped bring a different perspective to the rural development puzzle. Thus, when approached by Colombian Government representatives to collaborate with them in one of several similar model experiments they were planning, the Centre responded rapidly and wholeheartedly. Over the next five years the Caqueza Project, as it came to be called, became the scene of an intense learning process which influenced subsequent IDRC project support and its strong focus on understanding and building on existing production systems as managed by resource-poor farm families and communities.

This is not the place to go into more detail on the Caqueza experience. It is well described and documented in the above cited reference. The background and development of the project is mentioned here to help define the broader context within which the Peruvian and Bolivian projects were born.

At the same time as IDRC was developing its involvement in Colombia, it also responded to requests from the International Rice Research Institute (IRRI) and the University of the Philippines, Los Baños, in Southeast Asia to collaborate in their nascent work on multiple cropping. Research-station plot experiments on crop intensification by Dr. Richard Bradfield, testing practices and principles observed in China and Indonesia, had effectively demonstrated that four or five crops could be grown in a year on parcels where farmers normally produced only two (Zandstra, Price et al. 1981)**.** The amount of food grown on these plots was 4 to 10 times that of nearby farms drawing attention to the potential for greatly increased food production in other areas of South and Southeast Asia. Dr. Hopper observed this innovative but highly experimental work even before

IDRC was formally operational. He recognized it as being creative and based on important production principles but noted it failed to consider many of the management and economic realities faced by farmers. Consequently, he arranged for a young Canadian agricultural economist and farmer, Gordon Banta, to join Bradfield and begin building the links between the station experiments and the reality of farmers' fields.

This crop intensification work thus gave rise to on-farm research in the early 1970's funded principally by IDRC. At the time, this kind of work was hardly considered research by main-line agricultural researchers whose approach was strongly discipline based in agronomy, soils, entomology, plant physiology, etc. In several countries of Southeast Asia a number of agronomists and others who worked with farmers and observed their practices became interested in the ideas and work at IRRI and the University of the Philippines. Over the next three years IDRC funded projects linked to the IRRI work in Thailand, Indonesia, Sri Lanka, and Bangladesh. Since each of these projects was isolated from the main stream of research in its own institution, principally Ministry of Agriculture research departments or agencies, meetings and visits were regularly arranged between researchers in these projects. A strong training program to expose researchers to the new methodologies was developed and in 1975 the Cropping Systems Working Group was formed and later the Asian Cropping Systems Research Network. IDRC participated actively in the formation of these groups and supported some of their meetings and other activities in collaboration with IRRI and national programs. By 1980, when a major workshop was held on cropping systems research in Asia, national working group committees had been formed linking fifty research sites in eight Asian countries (International Rice Research Institute 1982). The proceedings of this meeting provide a good overview of the concepts and varied research undertaken by these groups. In 1981, IRRI also published a methodology for on-farm cropping systems research (Zandstra, Price et al. 1981). The main author of this manual, Dr. Hubert Zandstra, had been leader of the IDRC team in the Caqueza project in Colombia and in 1975 took over leadership of the IRRI CSR program.

Another approach to understanding and improving the production systems of small farmers with limited resources evolved in Central America at the Centro Agronómico Tropical de Investigación y Enseñanza (CATIE). IDRC supported parts of this program in Honduras and Nicaragua beginning about the time initial contacts were being made in the Andes of Peru and Bolivia. Part of the focus in CATIE adapted concepts from Ecology as a basis for understanding small farm production systems. Dr. Robert Hart, who prepared a course at CATIE and authored a publication on "agro-ecosystems" (Hart 1979), pointed out that tropical agricultural research had enjoyed relatively limited success because the conceptual basis on which it was founded was adopted from temperate zones without considering the very different ecology of the tropics. In temperate climates production involves populations of single crops and their interaction with influencing environmental factors. In the tropics, for the most part, the small producer manages a much more complex set of crops with many interactions between plants, soils, water supply, weeds, pests and diseases which Hart called an agro-ecosystem. This perception was later applied in the mountain environments of the Andes.

By the 1980's, a large literature on more holistic considerations of third world small-holder agriculture had appeared. Much of this was theoretical, coming out of universities especially in the USA, but a substantial part also described attempts to apply the concepts and methods in real life development projects. As computers and related analytical tools and methods became more widely available, more complex sets of relationships were considered and what began as cropping systems or animal production systems R&D work evolved into a Farming Systems Research (FSR) approach and methodology which takes into consideration all of the major enterprises managed by a small-farm family.

This very brief outline of the evolution of a more holistic approach to agricultural research and development in which IDRC actively participated, and in some areas provided leadership, provides a general perspective for the reader of where the Centre was coming from when it first became involved in supporting agriculture research in the High Andes beginning in 1976/77.

2.2. The Indigenous Andean Reality

IDRC comes out of a particular cultural, philosophical and scientific heritage, and represents a core belief system, which to a large extent, was shared by the educated and scientific research groups it supported in Peru and Bolivia. The intended beneficiary groups, however, originated and evolved in a very different context and environment. This origin and context has been well summarized by Mario Tapia (Tapia 1996) in his book on eco-development in the Andes.

For millennia, the Andean region of South America has been host to the evolution of complex natural resource utilisation systems based on indigenous experience and slow evolution. This was especially true of the Central Andes of Southern Colombia, Ecuador, Peru and Bolivia on lands exceeding 2000 m above sea level, in inter-montane valleys and on surrounding higher slopes. This region is one of the world centers of origin of indigenous agriculture and traditional agricultural practices observed today in peasant communities are the result of adaptations and additions in response to many influences over time.

It is believed that agriculture in the Andes began some 5000 years B.C. With the beginning of a sedentary lifestyle, greater social and productive organization was required and this emerged in the form of the *ayllu*, or clan; a group of families with common ancestral heritage which shared tasks and the same territory. The *ayllu* was the unit of production and also became the basis on which successive pre-Inca kingdoms or empires were organized. Little is known of these kingdoms and how they functioned. Nevertheless, vestiges were observed during the colonial period indicating close association between social organization and management of agricultural production. There is evidence that the *ayllus* were first collectors but subsequently domesticated various food plants and gradually developed ecologically sustainable techniques and strategies to support a growing population in a very difficult environment. Domesticated plants included the potato, bitter potato, other Andean roots and tubers, quinoa, kañiwa,

maize and animals such as guinea pigs and the South American camelids, llamas and alpacas.

Much later, when the Incas appeared on the scene, they contributed greater social organization to the diverse groupings of previous cultures. They incorporated these into an ordered system and introduced a kind of agricultural planning for management of the challenging environment. The collective regimen of property control of the *allyus* was modified separating significant portions of land for service of the Inca. The relationship of the subservient groupings to the Inca State was one of tribute payment, often excessive. On the other hand, these payments also carried a function of compensation for regions which suffered poor agricultural production in a bad year. Through this overall relationship, resources were accumulated to construct temples, fortifications, towns, agricultural terraces and irrigation canals relics of which exist to this day.

With the arrival of Europeans in the 16th century, exotic practices, plants and animals were introduced and, over time, integrated into the existing systems. Now, in addition to the crops and animals their ancestors had domesticated, farmers had access to barley, wheat, beans, horticultural plants and sheep, bovines, swine and horses. These introductions and their adaptation to local conditions and uses resulted in substantial changes to the agricultural landscape and in the management of the natural resource base. Not least among these changes, in terms of its impact, was the replacement of community ownership of land by private ownership. During the first stage, a period of about forty years, agricultural lands continued to be managed by the *ayllus.* Then, under the pretext of facilitating the task of converting the "indigenes" to Christianity, the e*ncomiendas* were formed in which a Spaniard was given authority over a specific territory and the people who lived there. This source of labour was then tapped to supply workers for the newly developed mines in support of the Europeans' wealth objectives. The resulting abandonment of the land led to serious hunger and health problems to which the Spanish responded by creating reservations in specific locations where natives were forced to live. The Spanish Viceroy appointed a leader or *cacique* for each concentration as a responsible authority.

This creation of native reservations was the origin of what later became known as indigenous communities although they had a strong basis in the earlier indigenous structure. As the Spaniards created title to more and more desirable lands, the communities began disappearing, especially in the coastal areas. The fertile inter-montane valleys were dedicated to the production of introduced crops of wheat, barley, beans, peas and the use of oxen to work the land supported by manual labour from the communities. Initial productivity was excellent on the deep soils of the valley bottoms and nearby gently sloping hillsides. When these crops were introduced on the thin soils of steeper slopes, however, yields dropped and a process of severe erosion was set in motion. On the slopes of drier areas, the mismanagement of introduced sheep resulted in destruction of the stabilising vegetation. In the coastal areas, large *haciendas* were formed in response to market demand for cotton and sugar while wool was produced by grazing sheep on the extensive grasslands of the sierra. Interest in alpaca fibre also developed into market demand outside the region.

In spite of difficulties, indigenous communities persisted and changed to adapt to the various political and economic conditions they faced. With expanding population, however, pressures on land available to communities increased and precipitated a series of hacienda invasions and social unrest. As a result, a drastic agrarian reform was implemented in 1969 by the military government of the day in Peru. A majority of the large land holdings were expropriated and allocated to the workers on these haciendas turned into various types of co-operative enterprises. On the whole, peasant communities did not greatly benefit in spite of the fact that this was one of the principle objectives of the exercise. A parallel objective was food self-sufficiency and hence the major orientation of the reform was on the large irrigated coastal plantations. Traditional community organisation was not taken into consideration in the reform. Instead, new structures were created which lacked the old social and cultural organisation built on indigenous knowledge of survival in a precarious environment.

In 1972, a census in Peru indicated that more than 3000 peasant communities were legally recognised in the *sierra*. Today, indigenous communities and their multiple variations include most of the rural population, occupying an extensive area, dedicated to agriculture and livestock production. Although not all communities have maintained the close social cohesion which characterise more traditional groupings, they have shown a great capacity for adaptation to technological, social and political change.

During the last half of the 20th century, the introduction of agricultural mechanisation, use of chemical fertilisers, pesticides and herbicides again transformed large parts of the production systems, including the use of hand labour. Agricultural extension systems and their agents insisted on promoting the benefits of modern technology based on intensified use of land, water and associated natural resources. The importation, promotion and adaptation of these foreign technologies was not universal or evenly spread, however, and the results have been diverse. Today, it is possible to observe dramatic contrasts in technology applications and their impact on natural resource management (NRM) in close proximity across the landscape.

In spite of all these introductions, a large part of the traditional technology has been maintained, especially under the conditions encountered in subsistence oriented Andean peasant communities, relatively isolated in their indigenous practices and culture. These systems survive because of their adaptation to the diverse and difficult mountain ecosystems within which they evolved. Still, few if any of these communities have not been exposed to the present invasive and expanding world market economy with various effects. Many failures associated with introduced modern production technology were the result of failing to take the mountain diversity into account. Programs were designed to improve agricultural production and productivity using inputs and management practices evolved within a very different paradigm.

2.3. Evolution of the Institutional Research Context in Peru and Bolivia

The foregoing section presents a summary of the origins and history of the beneficiary groups identified by IDRC for attention in developing its agricultural improvement

research support program in Peru and Bolivia. These groups, however, did not have their own research and development institutions with which IDRC could partner. Hence, intermediary organizations from the same countries were identified with interest in taking a more holistic approach along the lines of IDRC's earlier experience in production systems with partners in Colombia, Asia and elsewhere. These potential partners had their own conceptual, cultural and political roots which strongly influenced the results of IDRC supported projects. Key elements of these roots form the content of the following discussion.

2.3.1. University reform and promotion of indigenous culture

In Peru and Bolivia, the idea that universities should be more in contact with the societies that surround them had its roots in social movements spawned by the university student reform movement initiated in Córdoba, Argentina, in 1918. This movement had important influence on various intellectual, political and social movements throughout Latin America over the years leading up to the time when IDRC began the projects being reviewed in this study.

The University Reform of Córdoba inspired a Peruvian leader, Víctor Raúl Haya de la Torre, to create, in 1924, a Latin-Americanist party (the APRA)[1] which proposed a broad program of reforms. In his writings, Haya de la Torre replaced the term "Latin America" and its derivatives by those of "Indoamerica" and "indoamericanism".This revised terminology expresses one of the characteristics on which the Andean production systems focus was based, assignation of value to the indigenous component of the Latin American reality.

In Bolivia, the background political and social developments are marked by the Nationalist Revolutionary Movement (MNR) experience after 1952, led by Víctor Paz Estenssoro and Hernán Siles Zuazo, in what is called the Bolivian revolution. Bolivia had entered a kind of blind alley with no escape after defeat in two wars with Chile and Paraguay and the collapse of the world tin market on which its economy largely depended. By 1950, Bolivia remained a rural backwater without exports or industry and a completely stagnated agricultural sector utilizing scarcely 2 percent of its cultivable land surface. Land was in the hands of large property holders who, until 1945, benefited from

1 APRA stands for Acción Popular Revolucionaria Americana, or American People's Revolutionary Action. APRA and "aprismo" was founded by Haya de la Torre as a continental movement with national sections in the various countries of the continent. The Peruvian party was and is still recognized as the Aprista Party of Peru (PAP). Haya de la Torre dreamed of Aprista parties in all countries of Indo-America. Several national parties, even though they don't include the aprista reference in their official names, share the same ideology and were federated in a form of International. Such is the case of the Liberación Nacional of Costa Rica and the Acción Democrática of Venezuela which formed governments in their respective countries. And certainly, also the Movimiento Nacionalista Revolucionario (MNR) of Bolivia referred to in the text.

the system of *pongueaje* which obliged peasants under their control to provide services, generally in the city, without remuneration under semi-slavery conditions.

The defeat in the war of the Chaco had produced the resurgence of a new nationalism which proposed a revision of the social and economic structures of the country. This started with a criticism of the *latifundio* system and the tin production monopoly controlled by three large enterprises owned by Bolivians but which invested all profits externally. For students of the Bolivian reality, the revolution in 1952 "is a fundamental event …, to the point where it is impossible to comprehend the Bolivia of today without understanding (its) significance …" (Mesa, Gisbert et al. 1999).

The two principle outcomes of the revolution were the nationalization of the mining enterprise monopolies and the agrarian reform, commencing in 1953. By means of the agrarian reform the *latifundios* were eliminated and development of a process commenced for incorporation of the peasants into national life. Nearly 2 million persons, out of 3 million at the time, were incorporated as producers and consumers and the replacement of restricted voting by the universal vote in 1952, meant that 70 percent of the population, marginalized up until then, could participate in the electoral process.

Unfortunately, these hard won advances were diluted, as the MNR, like the *Aprista* party in Peru and other countries, evolved toward more conservative positions. Thus, the revolutionary push and values associated with agrarian change were completely lost, and along with it, the considerable popular support which had developed.

2.3.2. Theory and practice in rural development

The early pro-indigenous formulations noted above were later reinforced by other ideologies. Marxist thought, and particularly the Latin American adaptation formulated by the Peruvian José Carlos Mariátegui, strongly influenced Peruvian and Bolivian universities. His proposed interpretation of the Peruvian reality offered those who work in that reality an alternative perspective and possibilities of new understanding. In particular, this influence took hold in the schools and faculties of agronomy through proposals that theory and practice should be integrated. By claiming the necessity of combining theory and practice in action, the intellectual inheritance of Mariátegui encouraged research in the universities and research centers to be translated into concrete acts of change which would restructure the organization of production, distribution, use of natural resources, land tenure and the control of water. These ideas exercised an important unstated influence in many of the IDRC supported projects and of the scientific activity associated with them.

But for others who shared the same professional training in the same universities, however, that influence led to a desire for revolutionary changes, with or without the rural masses. Political and social movements arose such as the Shining Path (Sendero Luminoso) in the Universidad San Cristóbal de Huamanga (Ayacucho), an unavoidable landmark in the period covered in this study. The situation called for an examination of

many of the projects, of the environment in which they worked, of the groups which they supported and of the communities towards which they were oriented.

2.3.3. Agrarian reform

The currents described above were not the only stimulants for the agrarian and pro-indigenous focus. The Peruvian military government in power after 1967 had gained influence in a number of official organizations, but they encountered strong opposition in the universities which had already been won over by the *apristas* and by various branches of the Marxist family. An agrarian reform was imposed by this government which affected traditional mountain agriculture and rural communities. The reform sought to expropriate properties in the mountains of more than 35-55 ha (varying according to the region and production conditions), but expropriations were delayed due to the priority the government had given to the coastal, highly mechanized and very profitable sugar estates. This delay gave opportunity for many larger farmers in the *Sierra* to reduce the size of their properties, selling or giving lands to family members and thereby reducing the number of peasants as potential beneficiaries of the reform. In spite of this, the agrarian reform reached dimensions never before seen in Peru where similar, but very limited, experiences had been initiated in the past. It is estimated that three quarters of the expropriated lands were handed over to peasant cooperatives or communities.

While the Bolivian agrarian reform, referred to above, distributed the land to the peasants and originated a vast sector of *minifundios,* the Peruvian reform favored associative forms of production, the cooperative in the case of coastal *haciendas* and peasant cooperatives and communities in the *Sierra.*

Most of the studies on this period agree that, although the reform was not a total success in redistribution of income and increased agricultural and livestock production, it generated, particularly in the *Sierra*, a rupture in long-standing servitude relationships between poor peasants and estate farmers. The reform "proved (to be) a major economic and political benefit to a significant sector of peasantry" (McClintock 1982) 135.

In fact, many of the apparent benefits of the agrarian reform crumbled very quickly because the reform was not conceived as an instrument of development for the rural sector, but rather as a mechanism to achieve the support of the masses for the government. Incapable of deviating from a strategic military view involving, fundamentally, concepts of national security and territorial occupation, the military authorities acted to create supporting groups they could control. In this context, a new organization, the National System of Support for Social Mobilization (SINAMOS) [2], was created which subsequently influenced the development of a vast sector of non-government organizations (NGOs). At the same time, agricultural and livestock production in the S*ierra*, oriented to internal markets, was openly disadvantaged by policies that fixed prices by ordinance to favor of the demands of the urban poor. Basically, the objective was to avoid inflation and maintain the urban poor and middle

[2] Note the subtle play on words: SINAMOS – *sin amos* or, "without masters or owners".

classes relatively satisfied. Finally, the agrarian reform and the method chosen for payment of the expropriations through the issuance of 20 year agrarian reform bonds, redeemable for investments in the urban industrial sectors, resulted in a decapitalization of the agriculture sector. These policies facilitated the emergence of new classes, and the reinforcement of others, especially in the financial sector, and in new industrial sectors (fisheries, construction, etc.).

In the specific case of the S*ierra haciendas*, the agrarian reform mechanism favored the formation of new cooperative landholdings for the employees of the *haciendas* ignoring temporary workers and poor peasants from neighboring communities who, for the most part, were tributary to the large exploitations. In many cases, conflicting relationships between the *hacienda* and surrounding communities, were replaced by other, still conflicting, relationships between peasant beneficiaries of the reform who became members of the cooperatives and generally poorer and land-less peasants completely dependent on occasional employment. The conflict resulted in invasions of the cooperatives by traditional community members and a spiraling conflict among peasants ensued, a situation which the Shining Path took advantage of years later in some regions. Over a period of about fifteen years, the crisis situation involving lack of land and the unequal distribution of available land determined a large rural exodus (and exodus *Sierra*-Coast) which increased dramatically during the period of Shining Path violence.

2.3.4. The Bolivian situation

In addition to the already mentioned influences of the movements born during the first decades of this century, several additional considerations touch on the focus of this study more directly.

The projects in Bolivia were much less influenced by socio-political factors than those in Peru for several reasons. In the first place, the projects directly reached only a small number of organizations, principally related the Bolivian Agricultural Research Institute (IBTA). Although generally weak in many ways, the system of agricultural and livestock research in Bolivia maintained a relative stability over this period that has only come to be altered in the last few years after most of the projects were completed.

In the years during which the selected projects were executed, the agrarian reform was already well advanced and issues on the agenda in Bolivia dealt more with: the democratization of the country after the end to the dictatorship (1971-1978) of Hugo Banzer; the reorganization of the tin mining sector where prices had reached their lowest levels ever; the fight against severe inflation; combating unemployment which had reached catastrophic dimensions; and, control of the foreign debt. The most important change in the rural environment during this time period was the expansion of coca leaf cultivation and production of cocaine. Coca generated the only important agricultural expansion frontier of the country owing to the growth of its production in the Chapare region and the related rural migration that this production attracted. The new settlers, protected by isolation, were attracted to a commodity which was in great demand for

export and offered prices and productivity (normally four harvests per year) beyond any comparison with their traditional crops.

The new forms of land tenure in Bolivia, arising from the agrarian reform, didn't take into account the collective working traditions of the *quechua* or *aymara* populations and new levels of productivity based on technology improvements were impossible to obtain under *minifundio* conditions. Cooperative experiences were scarce. The model of land tenure chosen did not adopt the best it could have from experiences elsewhere and the agrarian structure became locked into a system which either obliged new property divisions to ensure the inheritance of fathers to sons or exiled peasants to the city to search for work and new living conditions. Instead of an integration of city-countryside in the social and productive plane, it facilitated a growing divergence in interests. Inflation and the need to maintain the support of the urban population obliged the governments to severely limit agricultural prices at the expense, once again, of the rural population.

Inflation during the period 1982-1985, the most severe in the history of the country, produced catastrophic effects in the countryside caused fundamentally by the suspension of bank credit in national currency and the corresponding dollarization of credit and inputs. The GNP continued a downward fall experienced for many years so that inflation approached 9,000 percent annually and the US dollar which had a value of 230 Bolivian pesos in 1982 reached a value of more than 1.2 million pesos in August, 1985 (Mesa, Gisbert et al. 1999). In reaction to this crisis, Bolivia became one of the first Latin American countries to apply neo-liberal economic solutions and structural adjustment plans which oriented the country toward an open market economy. But, once more, farmers did not benefit from these changes with the exception of the coca producers and the new livestock growers in the region of Santa Cruz. Rather, they suffered the consequences of market liberalization reflected in higher prices for inputs, higher interest rates for subsidized credit which they received from state banks, and competition with products freely imported.

In 1996, under pressure from peasant demonstrations, a new agrarian reform law was passed which for the first time recognized the original communities, traditional indigenous organizations, and the indigenous territories of the East (although these had received acknowledgement years earlier). The new law established better tax treatment for farmers and communities, recognized property titles to community lands, and awarded them new lands along with other organized indigenous groups.

2.3.5. Evolution of university and NGO collaboration

The institutional environment for the IDRC supported projects in the Andes of southern Peru and Bolivia created opportunities for an integration of university activities in rural areas with NGOs working in the same localities. As already seen, the growth in number of rural organizations corresponds in Peru with the period following the creation of SINAMOS and the expropriations of the agrarian reform. In fact, many organizations emerged during the military government period (1967-1980) as instruments of political

parties or factions and as intermediary mechanisms between the intellectual and political elite and the poor sectors.

By the late 1970s, the beginning of the period under study, universities and NGOs seemed to be valid interlocutors with the peasant communities and as more or less effective project executors. They possessed scientific knowledge and the universities had been opening up towards their surroundings in terms of "social projection" and collaboration with the NGOs in terms of service. Andean products received greater acceptance in the coastal markets, especially the Lima market where demand was increasing due to the large migrations from the *sierra*. The democratization of the universities favored "social projection»; the food crisis accentuated the rural exodus; and indigenous and agrarian orientation favored Andean crops and livestock.

With a worsening fiscal crisis after 1980 and related massive dismissals from government employment, the universities and the NGOs became a refuge for many disenchanted intellectuals and professionals where they could continue developing their ideas and projects. They were afforded a privileged refuge, mainly in the NGOs with project financing in hard foreign currencies that grew in value in the inflationary context of the time and provided superior remuneration levels compared to the normal labor market standards.

When the APRA came to power in 1985, a temporary revitalization of agrarianism and indigenous focus occurred, but these themes had already been appropriated with more force and in a more radical way by the Shining Path. As a result, the government found it impossible to introduce necessary reforms in the rural environment as it was forced to combat on other fronts such as foreign debt, bank reform, and the battle against the Shining Path. By 1987 the crisis of the régime was acute, its inability to act in the rural areas was clear, inflation reached levels never before experienced and the war against the Shining Path had been left to the military. Civil society and the government were impotent to confront either side and the situation in the field had deteriorated to the point where the peasant population was either polarized around the antagonists or suffering the consequences of being caught in between.

In 1990, against all the polls previous to the election, Alberto Fujimori became president of Peru. In spite of having been Rector of the National Agrarian University of La Molina and of being an agronomist, Fujimori arrived in power without a clearly defined agrarian program except for the incorporation of the agricultural sector into the market economy and the global economic system in general. In this new context, IDRC support to heirs of the previous projects evolved in a new context, dedicated to the reinforcement of civil society through consortia and other coordinating mechanisms with focus on NRM.

3. IDRC in the Rural Andean Milieu

In the foregoing, we paint a picture of the main themes and dynamic structure of the Andean milieu into which IDRC brought some *avant garde* ideas, for the time, about the organization of agricultural research and local participation. Before addressing the more detailed history and synthesis of IDRC support over twenty years of research and development activities, we would first like to explore some overall perceptions and relationships. Jumping to conclusions too rapidly regarding the impact and reach of the projects individually based only on what can be observed in the field today does not tell the whole story. In the following commentary we attempt to weave together what seem to be significant threads in the evolution of the ideas and activities presented later. These reflections respond to the questions posed in the introduction to this study about change and how IDRC participated in and contributed to that change.

3.1. What and who has changed

As we have seen, the agricultural situation of Peru and Bolivia has radically changed in the course of the past years. Urbanisation has advanced much more rapidly than in the past and in the Andes agriculture has been losing the importance it once held as a key economic activity. Both countries have experienced a transfer of decision-making power from the State (and secondarily from social forces) toward the forces of the market. Social actors have been individualised and the relatively weak power which social groups once had has been diluted even further by the growing power of individual decisions. In this context, peasants as a group have lost what little advantage they had gained through the agrarian reform process, policies related to favourable prices, or subsidies that benefited them as a group. This is not to say that there are no mechanisms through which these same peasants cannot still obtain advantages. But they are not determined by the social condition of being peasants and by the support that they can, for diverse reasons, attract from a government. The relative weight of a group in the market today is determined by its condition and ability to consume. In this game, the peasant sector has little weight because of low incomes, subsistence consumption orientation and limited use of high value inputs.

On this playing field, a process of differentiation has been operating among the rural masses. Rural life, production systems, and even the rural landscape, are changing driven by this differentiation. During the course of a field visit to the communities of Písac (Cusco) in the company of a project participant and witness to twenty or more years of change in the life of the communities, we were able to observe how certain elements of community life had radically changed. Two examples will suffice to illustrate changes that are not at first sight directly associated with the production systems research theme but yet are undeniably linked. On the surface they have more to do with the incorporation of the communities into the market economy and with differentiated access to that market among community members.

First, the introduction of the motorcycle as a means of transport. Motorcycles have been acquired by those in the community who, for one reason or another, were already in a better financial situation. This means of transport has permitted them to improve their position in the market for goods, facilitating the transport of products or of inputs, allowing access to localities where their products have greater value and where inputs are available at better prices. In 1980, the communities were to a large extent dependent on a single member with a pickup truck who acted as an intermediary. Today, the motorised peasant can also increase his mobility and availability in the labour market of the work force. Individual transport allows him/her to reach better employment opportunities that represent additional income to that obtained from family or communal lands. The diffusion of the motorcycle has also given rise to new occupations in the communities such as repair services and fuel deposits, creating, based on a division of labour, new possibilities of social differentiation and new sources of income.

A second change observed in the communities has to do with family housing. The quality of the materials used in construction has radically changed and this has produced noticeable changes in the rural landscape. Manufactured materials such as galvanised metal roofs, glass, doors and windows, panels and other items are used in construction replacing, although not totally, stone structures, roofs covered by metal pieces held down with stones, and other locally collected materials. Houses today have electricity and, in many cases, water wells with electric pumps and minimum sanitary services. Access to these goods is subject to the laws of the market and is the product of the differentiation operating in the rural population. This new availability of goods, while facilitating changes in important aspects of peasant life, has promoted further changes in the market for goods and services and introduced additional factors of social differentiation. As in the case of the diffusion of the motorcycle, new occupations associated with housing construction and repair have appeared that formerly, if done at all, were carried out by the owner or occupant. With these occupations, not only has a market for specialised manpower been developed but also that for construction materials and the appearance of new local commercial activities.

This dynamic of change was already present, although in incipient form, in the community centres that were constructed under the auspices of the projects supported by IDRC. These were, in a sense, pioneers of a trend that expanded with time. In these centres, service facilities such as carpentry shops, flour mills and bakeries, as well as other facilities, were constructed and organised such as in the case of the centre *Wasinchis* in Písac which served the communities in the above examples. Interestingly, the original service centre, constructed as a focal point for community interaction with the project has ceased to function although the facilities are still intact. It appears to have served its function which has now been superseded by individual initiative in various other more convenient locations in the four communities of the watershed.

To advance our analyses, as weak as individual decision-making power is in the market, the trends that somehow began to manifest themselves by the late seventies have become more or less permanent conditions in the economic and social life of the Andean world. This transformation of incipient tendencies into established practices has evolved in a dynamic way, entering into the game of forces that has been playing out. Manifestation of

this trend is encountered not only in the areas of the services mentioned and associated labour markets, but also more fundamentally in the areas of community organisation and production. Such is the case of the Andean crops and livestock production systems which constituted the focus of most of the projects studied. The output of these systems, though still destined largely to subsistence consumption, was gradually acquiring the character of market oriented exchange goods.

In the case of quinoa in the Bolivian *altiplano*, for example, the crop was important in traditional community production systems for both subsistence consumption and exchange for other products. With the initiative to improve the productivity of the crop and associated market development, demand started to grow. The image of the crop began to shift from peasant subsistence to one related to cultural heritage attractive to higher income strata in national society and internationally. Thus, from 1981, the area planted to quinoa began to increase and the grain took on new importance in local and an expanding international market. While underlying explanations for this evolution vary, and negative as well as positive results are recorded, the trend is clear.

The same thing can be seen in the case of alpaca rearing in which elements of continuity can be traced over a long period of time (see the camelids case study in section 5), and in spite of disruptions relating to situations prevailing in the communities before the beginning of this program. Certainly, alpaca fibre had been valued from colonial times but the integrated market for alpaca products has only been achieved in recent years. The disruptive elements represented important changes in the social conditions of the producers: in the distribution of wealth generally in favour of the communities; in a new vision of alpaca raising as a source of income; and, as well a greater integration of resources in the market.

Today, for example, CIRNMA, an organisation which evolved out of and continues initiatives from the PISCA and PISA projects in Puno, has organised a group of women and a workshop to knit various items of alpaca fibre. These are produced according to standardised patterns and quality control and a coloured catalogue of its products is available in addition to an internet web site with information on its activities. It has been suggested to CIRNMA managers that they now take the next step and offer their designs for sale through their web site on the internet. This idea arose from contacts through CONDESAN, of which CIRNMA is a member, and which trained CIRNMA personnel in the establishment and maintenance of their web site. Through this alliance and by means of a hot link with the CONDESAN web site, CIRNMA has the potential to capture more value-added for the Puno knitters whose products it markets and exports.

Marketing Andean products such as alpaca sweaters made in Puno via the internet is still just an idea but the fact that it can even be considered a viable possibility represents an immense step from a subsistence economy toward participation in the global marketplace. The basics are already in place in the form of standardised designs selected by means of consumer survey and an organised production and quality control system. Canned food products based on local raw materials, including smoked alpaca meat, have also been developed and are marketed locally but could be sold in the emerging

electronic marketplace. These are examples of what is likely to emerge in a not too distant future.

Given the changes illustrated by these examples, the notion of "production system" which at first referred principally to combinations of crops and animal husbandry as a means of achieving greater productivity, has expanded towards a global concept. In it, the crops and animals that are a starting point in the chain of decisions taken by farmers and their communities, become only one element in the expanded production to consumption chain of market influences. The altered context of rural life and agricultural production has transformed this linear view into a much more complex process of decision making. The traditional production decisions dealing with resources, weather and inputs change to encompass ones of what can effectively be produced beyond the necessities required by the rural family. The traditional rationale that considered only some elements in the process of making decisions and which was, in essence, a strategy of survival in a local environment, has evolved into an amplified systems rationale encompassing many factors. These factors now enter consideration myriad constellations: sometimes singly and sometimes in complex combinations; sometimes in a permanent manner and at other times in temporary or isolated ways; as definitively adopted innovations, or as a local, temporary adaptation; all in a continual play of trial and error experimentation.

The traditional peasant rationale and the changes induced by the project were well illustrated in a model developed by four PISA researchers (Claverías, Mamani et al. 1991). The authors studied two PISA communities, Apopata and Anccaca (Puno), and described how the producers accepted proposed changes when they fit with their own production and consumption context and objectives, whether for the market or for family subsistence. They reached a number of conclusions and recommendations aimed toward transforming externally designed projects into more endogenous activities from the perspective of the communities, considering technology as part of human behaviour acting on resources (land, water, plants, cattle, tools and others).

Although encouraging project focus principally on endogenous activities, IDRC facilitated a greater consideration of the dynamic between exogenous and endogenous influences. The experience of twenty years of projects in Peru and Bolivia demonstrates that, by incorporating community values and interests and associating them with the projects' own objectives, new ideas and values were developed, introduced and adopted. This process plays out in the world of science and development as well where, for example, in addition to the concept of "production systems", new concepts were incorporated such as "natural resource management", "environment", "sustainability", "gender equity", and others.

In this process of transforming production conditions, technological innovation becomes a means rather than an end in itself. Such is the case of the innovations incorporated into traditional *waru waru* construction techniques (see case study in section 5). From the first research carried out on this technique, although mainly of an archaeological nature, activities were oriented toward the transformation and improvement of this technology and not just toward its reconstruction.

In what could be called the "indigenous argument" approach, this research would have become an end in itself, the study of an isolated artefact. The systems "research for development argument",on the other hand, converted it into a means to an end. In the indigenous knowledge arguments of some actors in the Andes, traditional knowledge is considered as an isolated, absolute value. It derives value because it is autochthonous and such values are not debated or questioned. An important difference can be noted in the projects supported by IDRC. In the cases analysed, in general a broader dialogue can be seen between the knowledge acquired in experiences of the western world, or applied in other countries (Caqueza, Asian Cropping Systems Network, CATIE), and the experiences acquired in the indigenous world of the Andes. The projects supported by IDRC, many times without the Centre being aware, created conditions in which a variety of other social actors (NGOs, universities, research centres, field experimentation teams, government agencies, other donors, etc.) could take decisions, based on various sources of information and knowledge, in function of their own particular interests. This is the case of the advanced training opportunities offered by the projects or of the research on germplasm conservation beyond the existing and well-known indigenous varieties.

In addition, we would like to point out that many of the projects that lay claim to providing better technologies, plant varieties and Andean livestock improvements would not have been possible without the growing appreciation of historical context described in the background section above. When IDRC decided to support its first projects in the region, social actors, development agents, researchers and actions already existed that had been influenced by a growing recognition and validation of the indigenous Andean world. These individuals became the main partners of IDRC (as project leaders and participants) and even its own agents in several cases (as program officers). They helped determine the orientation of the projects that IDRC, for its part, funded but only partially defined and guided.

To conclude this section, it is important to note that these changes should not be idealised for two reasons: first, because many times such changes had nothing ideal to offer in the real life situations of poor rural families; and, secondly, because the changes took place in the midst of contradictions as other problems were frequently encountered. We will return to this issue later with some strategic questions posed by these contradictions.

3.2. How have they changed and how did the changes take place

From the discussion above, it can be seen that the notion of "production system" takes on the form of a complex set of interactions, including contradictions, that occur in rural life and production practices in a permanent way. But this condition is not static as it continues to incorporate new elements while abandoning others. The diagram below illustrates the interplay of some of the many variables involved in rural community development and change as follows.
It is important to make a distinction between endogenous and exogenous variables in the communities involved in the projects. The former derive from conditions given by community and family needs, by the socio-historical setting and by the geophysical resource base. These three endogenous groups of variables are linked and changing and

it is the dynamic of this interaction between variables, and that inside each set of variables, that defines the starting conditions of a project.

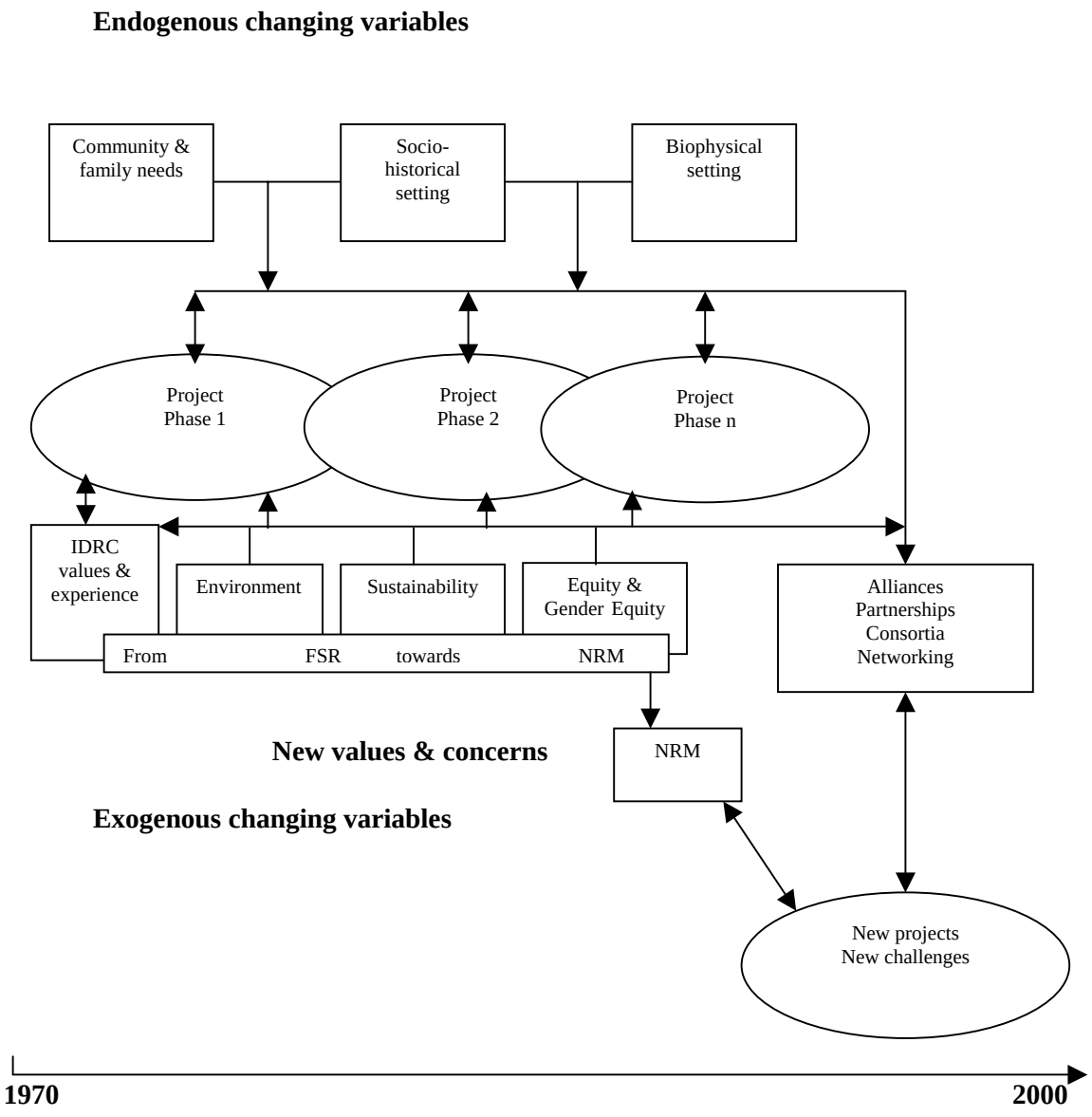
Endogenous conditions alone were not sufficient to give rise to projects exploring avenues of change, however. It was external or exogenous variables and perceptions of new opportunities for the rural communities that made possible the initiation of the projects spearheaded by IDRC. Among these can be included the knowledge and the set of values and concerns that IDRC brought, emerging as they did, from its own mission definition and from past experiences in other situations and countries.

New values and concerns continued to appear over time. For IDRC they involved an evolution of thinking with respect to production systems along a continuum from cropping systems and animal production systems to the more integrated farming systems research (FSR) approaches which included insights from the social as well as the biological sciences. This evolution proceeded to a further level of conceptual integration in the form of natural resource management (NRM). The FSR approach and methods do not disappear but continue, nested within NRM, to be applied as needed. In IDRC, the more inclusive concept of NRM has become sufficiently consolidated to be considered increasingly endogenous, or internalised within the Centre and its programs.

New projects and challenges emerge from this growing awareness of NRM complexities and as a consequence integrate new actors and ideas into the scope of projects (alliances, partnerships, consortia, networking). These actors are also influenced by their basic settings (biophysical, socio-historical and community) but at a more macro level, not limited to the influences of small communities. This change of level and increase in the range of influences and interactions tends to augment and blur the frontier between endogenous and exogenous variables and break down barriers to broader productive interaction.

Finally, it is worth noting that the new projects and challenges are also influenced by the existing projects and that their continuity is characterised by the overlapping of actions and ideas at different moments in time and by the interaction between learning in past projects and experimentation in new ones. Not depicted in the diagram are the potential negative effects of other exogenous variables which result from change and greater integration into a market driven economy.

Community Project Dynamics
1970-2000



3.3. In what way and in what elements has IDRC contributed to change

The focus of IDRC has changed over the years in the projects that it helps finance related to agriculture and rural development. Its emphasis on production systems, while novel and innovative in its time, originally tended to consider projects in a relatively contained way, almost as closed systems assuming solutions to problems of income could be resolved mainly through improved productivity. This is a simplification to be sure, but a review of Program of Work and Budget documents from the period indicates this was generally a characteristic of all Centre programs dealing with technology and technical change at the time. In the Andes region, Centre representatives and the researchers it supported initially followed the typical interpretation of traditional Andean society which described interactions among various actors in a linear way, in terms of a closed set of dependency relationships. This situation no longer holds and rural societies have evolved towards new levels of complex interdependence and IDRC has participated in this metamorphosis. As the roles of traditional actors, such as the communities, the State and the sectors representing economic power interests (in some cases landowners, in others merchants or middlemen) faded or became more complex, new social actors stepped forward. Among these have been the universities, new research centres, private research groups, the CGIAR centres, NGOs, and farmer organisations all of which have been IDRC partners and have taken advantage of its support to advance their research and change agendas.

With the advent of new global perspectives and development challenges, IDRC sought newly creative ways to deal with the broader issues of the environment (particularly after the Rio Conference in 1992 when it was given responsibility for Canada's response), natural resource management, and a focus on equity in general and gender equity in particular. This expanded horizon lent itself to a focus on greater understanding of the dynamics of the processes of change, including technologies. As a result, it became necessary to address rural societies as more direct participants in this learning process and something more than subjects to be studied in the formulation of the projects.

In the countryside, interactions were also becoming more complex, motivated by social actors and actions that reached well beyond traditional contacts and influences. The multiple agents of a diversified market-place began to make their presence known in areas where, in the past, contacts with this wider market were minimal, limited to the near monopoly of the middleman. Under the new conditions, technical and other services from the specialised agents of development organisations or from sales representatives of enterprises selling inputs have entered the picture. The situation has progressed, weaving ever more complex relationships, promoting alliances of varying dimensions and creating new and broader circles of influence.

The communities themselves became an increasingly monetized market. When farmers traditionally saved and planted their own seed, except for subsistence security, seed may often now be purchased from a supplier. When there is more than one supplier of seeds, the competing interests demand increased attention and decisions on the part of the producer. A private supplier may only be interested in selling a particular type of seed,

but the producer may also have access to agricultural extension services, provided by government agencies, or by an NGO which could be promoting a combination of technologies to address issues that go beyond simple productivity to consider sustainability, environmental protection or genetic diversity. The decision-making challenge of the Andean peasant in his/her community has become exceedingly more complex as has the challenge to organisations like IDRC that seek to assist him/her with viable and sustainable options.

In section 2, we outlined some background experiences for the development of IDRC supported projects in the Andean region. These were developed in a context of huge investment, green revolution inspired, integrated rural development projects focused almost entirely on increasing productivity. Researchers in the Andes recognised that peasant objectives and needs could not be satisfied by activities focused solely on increased productivity or even on increased total income if based only on a single commodity. They also brought a strong commitment to better understand and interact with the indigenous populations they wished to assist. It is our interpretation that this focus in the programs supported by IDRC was, with time and despite many weaknesses and errors, one of their strengths. Indeed, to the degree that responsibility was placed on local actors and their results could be extrapolated to other experiences, the programs had a real impact that translated into lasting changes and reached outward to other communities and organisations. In the course of our field visits we were able to verify the current existence and reach of many of these changes.

In seeking deeper understanding and changes than those induced by extension initiatives, preference was given to projects that signified substantial modification to traditional approaches and focused on building strongly from normal community practice with local universities and NGOs as partners. Contrary to the practices of other international development organisations, IDRC did not play the role of central actor, but rather that of a catalyst. In this sense, the rehabilitation of the *waru warus* around Lake Titicaca is a good illustration (see case study for details). The research was innovative in content and in focus and a large program of additional resources and organisation were mobilised based on the results involving communities, the local university, NGO's and development funding agencies of other countries. The impact is demonstrated by the fact that this technology continues developing, and its reach by the variety of development actors and resources attracted in its development and expansion.

Another example is the development of improved alpaca husbandry associated with market development initiatives. Impact was achieved through the number of research activities that the initial projects were able to stimulate producing research products such as student theses, articles in magazines, and technical reports. Project reach came later as evident in the number of producers and communities that have adopted the more efficient husbandry practices and followed the experiences of initial adopters who realised the benefit of raising this species for expanding markets and not just for subsistence consumption.

Of course, these changes did not come about without some of the negative or conflicting aspects associated with most change processes. Many problems are evident in the project

descriptions and history presented later but a brief example is given here as illustration. Let us return once again, to the case of the *waru warus*. The results of the research demonstrated that large areas of low lying land around Lake Titicaca could be used for more intensive food production than just seasonal grazing. This generated enthusiasm on the part of several organisations and the government to build quickly on these results and substantial funds were invested in a *waru waru* reconstruction program. Ambitious targets were set in terms of area to be rehabilitated without adequate quality control of the work. One account of the experience (Tapia 1999) notes that the hasty approach taken in order to achieve rapid and impressive results was not the most appropriate because in constructing the raised beds all in the first year, too much material from infertile sub soil layers was placed in the beds resulting in poor plant growth and low yields. A slower, longer term development process based on construction in stages over a number of years would have allowed gradual build up of fertility in the soil of the raised beds with better production from the beginning. It would also have spread out and reduced the cost of construction in terms of capital and labor investment. The application of the results moved rapidly in response to political and development pressures and the learning process involving research was not incorporated adequately into the program.

An analysis of these impact and reach experiences, as well as of their contradictory characteristics, leads to two observations related to IDRC supported project interventions. Firstly, impact and reach should be characterised by durability or sustainability. This concept combines not only an impact dimension at a particular point in time, but also continuity and predictability over time. Further, that which is durable or sustainable must be capable of assuring its own reproduction and continuity in an organic sense. Durability demonstrates inherent qualities directed toward the elimination or modification of conditions that result in negative consequences and thus addressing the root causes of a situation and not only its symptoms. From another perspective, this process can be referred to as a kind of institutionalisation.

It is difficult to identify durability in the IDRC projects taken independently because they were time limited and fundamentally concerned with research in which direct cause-effect relationships are not easily identified. The output of the research only took on broader applied meaning within communities through efforts defined by other organisations and by farmers themselves. Where projects are executed under the rubric of "research for development",recognition is accorded to the many action fields involved, and the need for linkages and alliances, in the necessarily limited and focused content of specific research experiments and projects. Addressing the causes of environmental degradation and underdevelopment is a process that requires a broad dimension of linkages beyond the scope of any particular project or even organisation. This can be illustrated by the complex of activities, organisations and interactions involved in the research, testing, diffusion, adaptation and adoption of genetically improved varieties of plants and animals and their related packages of management options.

An example of this process in action comes from comments recorded during our field work. Over long periods of subsistence agriculture and replanting their own seed, farmers in the Andes were experiencing low and ever diminishing yields due to the genetic deterioration of their limited seed stock. In work supported by IDRC, researchers

encountered traditional systems of seed storage maintained by women who carefully guarded a large pool of important genetic material which was not in general circulation. Laboratory studies showed the potential of using this material for improving productivity and through the organisation of seed fairs for local exchange and distribution of quality seed, encouraged producers to begin abandoning their subsistence mentality with respect to using their own seeds year after year. In great measure it is the women of the communities who attend and participate in the seed fairs. One of the causes of underdevelopment in the communities, although certainly not the only one, was thus attacked and new possibilities opened up for increased productivity, for reduced risk of crop loss and for greater income. Based on this experience, new development challenges were posed creating a new dynamic in mutually reinforcing activities. The seed fairs generated consequences in the invigoration of peasant organisation, such as in the role of women in their communities and in efforts to maintain agricultural diversity.

Secondly, the experiences studied reinforce the idea that in order for changes to manifest durability in a qualitative sense, they require time not only for the changes to be expressed, but also for consolidation to take place. Although this may seem a conservative position, it expresses the reality of the internal dynamic of change in the Andean world as it has functioned for centuries. From the point of view of IDRC, an important question to be posed in this context is, over how long a period of time should support for research be continued. In many projects, a continuity was observed that some might interpret more as repetition and a form of perpetuating dependence on IDRC as a source of financing. This issue is pertinent because, in the field of research, the time to impact is intrinsically long and the fruits of investigation are not normally manifest before a considerable lapse of time and numerous, repetitive experimental tests. This question of project maturation time is closely related to the need to produce evident changes that will take on some condition of permanency.

Without purporting to have a definitive operational answer, we would suggest that research for development actions should be prolonged for a sufficient period of time to allow observable, recurrent effects to appear and to permit measurement of cause-effect relationships with a reasonable degree of predictability. Continuing support needs to facilitate new actions which further consolidate previous advances. This type of reinforcement is illustrated by projects which included graduate degree programs and university research related training. It was also demonstrated by the continuity observed in the camelid projects with IVITA. IDRC support was initially technically thematic but later, and in spite of early internal difficulties, results were introduced through active alliances with others. This gave the program greater impact, to the point of producing sustained improvements in alpaca productivity, enhanced IVITA capability to identify needs and market its results, and over time, more depth in its reach.

Causal relationships in research and development are notoriously difficult to ascertain and ascribe to narrowly-focused influences and actors, including funding agencies. There is a dilemma here in that a narrow technical approach appears easier to measure and ascribe results than a broad multi-issue, multi-actor initiative. Yet, the results of a strongly focused agenda are usually limited without eventually diluting its claim to fame through the filter and combinations of many other development processes and actors. In

the IDRC projects, we have noted a continual play between these two agendas and the broad field of possibilities in between. It usually took several phases of a project to establish a base and build the range of alliances necessary to affect change. By that time, direct claim of association with visible advances and any consideration of a strictly cause and effect relationship was rendered illusory. A different paradigm is needed to judge and value the contributions of any particular actor or organisations to the economic and social changes inherent in development. Current research in IDRC on "Results Mapping" may provide at least a partial solution to this perennial dilemma.

3.4. What alliances were formed, for what purpose, and how did they function

In the course of our study, we have observed a complex set of new relationships evolving among many actors. This complexity is exacerbated by the fact that declared positive intentions may have within them unrecognised negative implications and latent threats that complicate the development process. In some cases, the introduction of a new input under the pretext of increasing productivity and sustainability has brought with it new dependencies on input and credit suppliers. In others, after the active support and encouragement of an NGO, an extension service, or a field experimentation team, these actors have been joined or superseded by a for profit enterprise which views producers individually in terms of profitable customers in the chain of activities from which the company generates its income. These relationships led producers to abandon elements of the traditional subsistence organisation of their community and act more individually taking on the responsibility and risks of pulling together and orchestrating their own production and income generating enterprise.

Through this process, and others, traditional communities have been evolving over a long period of time and continue their gradual adaptation of technologies and the alternate organisational modes or associations offered to or forced on them. Any agency wishing to influence that process therefore, also needs to be aware of and participate in a complex set of relationships as well as be around for a substantial period of time to understand how they function. Informants and participants in past projects indicated in interviews that IDRC was seen to stand behind its selected projects and activities in a consistent and supportive manner. Interestingly, it has been difficult to find public organisations able and willing to do the same and gradually build a set of focused relationships. Government funded and managed ministries or agencies were more supply oriented in their services and experienced constant reorganisation and shifts in focus in response to changing political and economic views. Even the collaborating universities encountered difficulty in pursuing objectives beyond their own narrow sets of interests.

The description of collaboration with INIA and IBTA in the next section, demonstrates the difficulty of introducing a new and more integrated approach or program within an established organisation as was the intent in the PISA project and in the Bolivian quinoa projects. Bolivia may provide an interesting alternative, at least in the plans for its latest reincarnation as the new decentralised Bolivian System of Agricultural and Livestock Technology (SIBTA), a framework of alliances for research and development based on autonomous ecoregional entities. One of these is the PROINPA Foundation which has

responsibility for quinoa research and thus is heir to the results of IDRC support. The highly bureaucratised experience of a very centralised organisation dependent on political power for its support will have been replaced by a new form of interaction involving greater participation of local partners in research and in development action.

Awareness grew that the target populations are not only objects for the specialists to study, but also become important executing partners in research for development actions. This opens the way for the notion of participatory research and requires extension of the alliances around which research for development actions and projects are built. These alliances necessarily include: the target populations and their different groupings; their organisations; the varying available human resource qualifications; and, other possible supports. This demands that the arrangements be participatory, democratic in their origin and in their administration, and transparent in their composition.

What is clear from the field observations and in the case studies, is that all the social actors no longer consider themselves as independent elements but rather as components of a complex organization of actors in which each must find a niche in multiple alliances.

This evolution is also evidenced by changes in the relationships and partnerships in which the Centre participated. In a study of IDRC networking, Bernard (Bernard 1996) notes that by the mid-nineties, IDRC was strengthening a "networking" concept as a fundamental strategy in its action mechanisms. This took the approach beyond the original sense of linkages in which networking encompassed a combination of relationships, mainly North-South in terms of transfer of funds and knowledge, and simultaneously, South-South in exchange of experiences. In some cases, the concept evolved to greater formality when it began to take the form of several more permanent arrangements which amounts to a type of institutionalisation for defined purposes. Two Latin American examples of this evolution worth mentioning are RIMISP, a specialised network focused on production systems research methodology and CONDESAN, a wide consortium or organisations working on sustainable natural resource utilisation and management.

IDRC’s support for consortia can be seen as an attempt to bring some order and greater user accessibility to the services provided within this expanding set of relationships, conditions and alliances. With the plethora of organisations and agents seeking to develop and promote their own particular commodity or service approach, resources are wasted and clients left confused by multiple offerings they may not fully comprehend or want. In the move to considerations of sustainable NRM, market development and coping with competition and unemployment, it is evident that simple forms of actor organisation based on traditional systems are inadequate. Research and development work is still required in traditional areas of specialisation, but responding to rural needs from a producer’s perspective requires preparing a range of packages which respond to many individual situations and problems not addressed on a speciality basis. No one organisation can handle all this and the idea of a consortium is to form alliances capable of addressing issues on a broader basis than any one of the partners could achieve with their own resources and programming focus. Through this mechanism, mutual interactions are reinforced as are the capacity for beneficial influence, the possibilities for

replicating successful experiences, and the benefit from mutual learning starting from the errors that should be avoided. This concept is still insufficiently developed, but IDRC support for work at pilot or benchmark sites, linked to a broader consortium of partners, is contributing to this learning process.

4. IDRC Supported Agriculture and Natural Resource Management Projects

The High Andean region (lands above 1500 m.a.s.l.) constitutes an extensive area in South America which covers more than 200 million hectares. In the case of Peru and Bolivia, this area is mostly inhabited by descendants of indigenous cultures speaking *quechua* and *aymara,* which follow a strong agricultural tradition and exhibit a cohesive, community based, social organization. They use traditional tools and technologies and manage crops and livestock from the region. Most peasants have small areas of marginal agricultural land combining individual plots and common use areas in the communities. Parallel to this traditional system, producer associations and small to medium size *haciendas* are also encountered. These are the product of changes in land tenancy induced by the land reform processes already noted which ended the existence of the immense *latifundios*, relics of colonial times. Under these conditions, standard research and extension services are particularly weak.

It is important to note that the High Andes constitute one of the areas of the world exhibiting great bio-diversity, especially in the botanical families and genera from which selected species contribute substantially to the worlds food staples (potatoes, Andean maize, beans, and several fruits). Animal genetic resources include the camelids of the new world, llamas, alpacas, vicuña, and guinea pigs. The diversity in crops and animals is an indicator of the wide ecological and climatic range encountered in mountain areas and to which traditional cultures learned to adapt.

Although it was very active in Asia and Africa, by the mid-1970's the AFNS Division of IDRC had developed very little activity in the Andes south of Colombia. A regional office had been established in Bogota in 1972, but program focus of AFNS staff based in the region revolved around the Caqueza rural development project of the Colombian Institute of Agricultural and Livestock Sciences (ICA), and the major CIDA funded, IDRC administered, support for the cassava research program of the International Tropical Agriculture Research Center (CIAT), both in Colombia.

This situation was remedied in 1976 with the hiring of a Peruvian animal nutritionist (Dr. Jose Valle-Riestra) who was based in Bogota and charged with developing the animal production component of AFNS programming in the region. Soon after his arrival, Dr. Valle-Riestra planned a joint reconnaissance trip to Peru and Bolivia with an Ottawa based program officer (Ed Weber) who had participated in monitoring the Caqueza project and was currently leading IDRC support for the cropping systems research network in Asia. Mr. Weber had lived in Latin America before joining IDRC, knew the region and spoke Spanish. Together they began to map out a strategy for developing a network of projects focused on some of the poorest rural communities of the hemisphere, the indigenous communities of the inter-Andean valleys and high plateaus (*altiplano*) of Ecuador, Peru and Bolivia.

In addition to the more widely known plants, noted above, the region is also home to a variety of Andean grain, root and tuber species not found in international trade in the 1970s or even known outside the countries in question. Quinoa (*chenopodium quinoa)*

and the South American camelids (alpacas, llamas) were identified initially as having potential for productivity improvement and quinoa in particular was of interest for its relatively high and nutritionally well-balanced protein content. These so-called "neglected species" held at least some interest on the part of a few national agricultural researchers but for the most part they were viewed disparagingly by mainline researchers. It was the former who were sought out during that first exploratory journey.

A key contact seemed to be Dr. Mario Tapia, a Peruvian agronomist and range land management specialist living in La Paz, Bolivia. The Inter-American Institute for Cooperation on Agriculture (IICA) had several years earlier created an Andean crops project and hired Dr. Tapia as technical specialist in that area. Contact had also been made with the director of the recently created (1975) Instituto Boliviano de Tecnología Agropecuaria (IBTA) to explore possibilities for collaboration. Both contacts turned out to be productive. Dr. Tapia was working closely with IBTA and participated in the meetings with IBTA officials then assisted them in preparation of a proposal to IDRC.

4.1. Projects in Bolivia

4.1.1. A focus on Quinoa (76-0078, 80-0115, 85-0012)

Although IDRC was looking for opportunities to support the development of more holistic crop or animal production projects, initially, it did not seek to develop "farming systems" type projects. This would have been unrealistic given the state of understanding of that approach at the time and the level of experience of trained staff with a systems perspective. Thus, support in Bolivia began in 1977 with a focus on modifying the Quinoa plant in ways that would increase its productivity on farmers' fields. Over time, and as part of the process, the IBTA team was encouraged by IDRC representatives to pay more attention to farmers and traditional communities and their perception of how productivity could be improved. Most of the work was concentrated on the experimental stations as IBTA was not organized to easily facilitate on-farm work. The evolution from this strong on-station, controlled environment, orientation to include a more on-farm based, production systems research approach, is described in Annex 2 detailing the various project phases.

The objectives of the first project were quite ambitious for a three year undertaking including, as they did, an increase in quinoa production, reduction of food imports, improved nutritional status of the *altiplano* population and increased incomes and employment levels for rural *altiplano* residents. Production packages for farmers were to be produced and training provided for both technical staff and farmers. The normal range of problems encountered in a relatively weak institution in a politically and economically unstable environment were all experienced. Nevertheless, after four years, the project was judged to have been more than satisfactory in its technical achievements by IDRC representatives and several independent, experienced plant breeders who reviewed the program (PCR,12/05/87).

A second phase to the project was signed in July, 1981, which continued for an additional four years. Although not part of the original objectives, cropping systems studies were initiated in the project as a result of IBTA staff interaction with IDRC and other Andean network projects (PCR, 15/12/87). Technologies and practices tested on-station were evaluated on-farm but there was no follow-up to assess the impact of this interaction beyond the immediate experiment observations. In addition to substantial further progress in the breeding program and in on-station cultural practices testing, production and sale of improved quinoa seed amounted to 13,800 kg in 1984, sufficient to plant 2700 ha. Four improved varieties adapted to different ecological zones were ready for release in 1985. Two project staff earned M.Sc. degrees in Mexico, 125 farmers participated in five training courses and project staff prepared 22 publications.

These results were accomplished despite problems with staff stability under the extremely volatile political and economic conditions in Bolivia at the time. Higher salaries and more secure positions elsewhere led to migration of experienced staff to other public institutions and the private sector. The greatest assurance of continuity in terms of technical excellence and administration was provided by Ing. Humberto Gandarillas, a retired pioneer in quinoa breeding hired by the project. He also served as a consultant to support quinoa improvement initiatives in Peru and Ecuador supported by IDRC.

Research activities carried on into a third phase initiated in 1985. The wording of the objectives reflects a shift from the early focus strictly on improvement and development of the quinoa plant to an explicit concern for its utilisation by small farmers within their management complex. Expected project outputs included a better understanding of the interactions among components of highland production systems, a much more complex research undertaking. Indicative of growing integration in programming within IDRC was joint funding from both the Crops and the Animal Production Systems sub-programs. Also indicative of growing external collaboration was the participation of the French agency, ORSTOM, in the project with a contribution valued at $230,000.

As a result of the project support from IDRC, quinoa was designated as one of six commodity-oriented programs in IBTA and national statistics indicated that areas planted to quinoa had increased from 12,000 to 46,000 ha between 1978 and 1989. Over the life of the third phase of the project, an average of close to 25 t of quality improved variety seed was distributed annually by IBTA and by regional development institutions. Production recommendations for intensive, medium and traditional cultivation practices were made available to farmers and small machinery was developed for soil preparation, sowing, fertilization and irrigation. A book on "Quinoa Production Systems in the Altiplano" was published by IBTA in 1987 and the National Quinoa Growers Association was organized in 1986 in which IBTA participated along with farmers, communities, regional corporations and purchasing agencies.

Towards the end of the third phase, it could be said that the research on quinoa and its outputs had been institutionalized in Bolivia, not only in IBTA, but in other organizations as well which distributed seed, purchased and marketed the increased production and processed it for use in other products. Still, the impact with small farmers was less than

desired originally since the greatest increases were encountered in medium to larger size farms which generally operated in areas with relatively better production conditions.

4.1.2. Quinoa production and limitations

Two external evaluations arranged by IDRC paint a broader picture of the context and influence of the IDRC work on the production of quinoa and its impact in Bolivia. The first evaluation was commissioned on completion of the third phase of the quinoa projects (Estrada, Gorad et al. 1992) to examine the results and impact of the work supported. The second, entailed a look at quinoa production and markets internationally and in the three main producing countries of Bolivia, Ecuador and Peru (Conforte 1997). In addition, an unpublished, end of mission report (Risi 1995), prepared by an advisor to the IBTA quinoa program in the context of a World Bank project provided further information and insights. This latter project was in part built on the knowledge and capability established by IBTA with IDRC support.

In the years following the initiation of IDRC support for quinoa improvement by IBTA in 1977, many changes took place. Although the crop was important in the Bolivian *altiplano* production systems, and formed a central part of the rural food basket, it had previously received little attention because of its status as a subsistence crop traded mainly among traditional communities in exchange for other products. About 1981, the area planted to quinoa began to expand and yields increased in some areas. In part, this was a response to the opening of export markets and the general enthusiasm this generated, especially among producers, even though there was little appreciation of the stringent demands of such a market. Quinoa production and area sown to the crop for the years 1980 to 1991 are shown in Table No.1.

Table 1: Bolivian quinoa production (mt) and area cultivated (ha) for the period 1980 - 1991

Year	La Paz (north)		Oruro (central)		Potosí (south)		Others*		Total		Av. Yield
	ha	Prod.	ha	Prod.	Ha	Prod.	ha	Prod.	Ha	Prod.	
1980	4 690	3 240	7 470	3 755	3 110	1 750	100	30	15 640	8 935	571
1981	13 255	7 200	6 555	3 580	2 955	2 075	275	185	23 040	13 040	566
1982	13 030	7 000	8 200	6 135	3 360	2 450	340	200	24 930	15 785	633
1983	21 799	4 122	8 529	5 625	12 427	1 803	340	150	43 095	11 700	271
1984	18 157	8 740	9 067	5 023	5 694	2 171	194	86	33 382	16 822	504
1985	18 799	8 422	9 419	5 339	19 479	7 249	252	143	47 949	21 153	441
1986	19 720	8 889	9 580	5 403	13 069	5 024	371	200	42 740	19 516	457
1987	21 390	10822	10 843	5 378	14 640	7 569	327	230	45 601	23 999	526
1988	20 234	10056	10 494	5 059	14 549	7 289	342	159	45 601	22 563	495
1989	19 987	9562	10 131	5 123	15 672	7 134	306	167	46 096	21 986	477
1990	20 957	6223	9 879	5 223	14 735	4 022	216	109	45 787	15 685	342
1991	16 383	8016	8 075	4 893	9 017	3 916	316	165	33 791	16 990	503

* Cochabamba, Chuquisaca and Tarija
Source: MACA Statistics, extracted from (Risi 1995).

The large variations in production and area in some years are due to the unpredictable nature of the climate on the *altiplano*, especially in the southern section where

precipitation is scarce and erratic and frosts can be encountered at crucial times in the growth cycle of the plant. Because of the arid conditions in the south, chemical fertilizers are ineffective and thus not applied. This, combined with the large white grains of the main types grown, called *Real*, resulted in a market niche in the organic health food market of North America and to a lesser extent in Europe. Quinoa grown in the central and northern *altiplano* zones are smaller in grain size, darker in colour and are sold in the national market or exported to Peru.

In the north and central altiplano quinoa is grown in rotation with other crops (potatoes, faba beans, and barley or oats for forage). It is grown on small plots, mainly for family consumption in the north, while in the central area, where more land is available per farmer and mechanization possible, more area is dedicated to commercial production of quinoa. Yields are low, averaging around 500 kg/ha, in the north and the south where no fertilizer or pest and disease control is used, and land preparation is poor. In commercial production, however, where land is better prepared and nitrogen fertilizer is used, yields can reach 1000 to 1400 kg/ha. Commercial production uses IBTA improved varieties because of their greater yield potential and grain quality. Producers are also better able to access the services of CORDEPAZ which grants credit for inputs and provides tractors for land preparation at low subsidized rates.

The quality of the research station work was solid, especially in the aspects of genetic improvement and agronomic management which were the main objectives of the IDRC support. Advanced lines from the breeding program were of high quality in terms of yield and grain characteristics and agronomic research determined optimum cultural practices. A germplasm bank of quinoa and related species was established to assure the preservation of genetic diversity. Despite these successes, advances related to frost and drought tolerance were limited.

In spite of efforts to disseminate the improved varieties obtained from the research through development organizations, insufficient field monitoring was done to document the advantages of the new varieties under real conditions. The evaluators concluded that the new varieties did not provide a solid comparative advantage on-farm because they were developed to respond to the best environments and care while quinoa production was being shifted by smaller farmers into marginal areas. They also concluded that the increased area dedicated to quinoa production in recent years responded to a unique and unstable set of climatic, biological and economic inter-relationships with little potential for long term sustainability. Subsidies were an important part of these factors and, because they influenced greater production of quinoa in fragile areas of the southern *altiplano*, this was generating environmental deterioration which in turn would be a major limiting factor in expanding quinoa production.

In the end, it was concluded that in order to improve the comparative advantage of Bolivia over other countries in the production of quinoa, and to increase the incomes of the poorest producers, production efficiency needed to be augmented substantially. To achieve this, not only must technical aspects be addressed but also the policies which encouraged subsidies and donations on which producers came to depend rather than on their own productivity.

4.1.3. Quinoa production and markets.

In 1997, IDRC contracted a consultant (Conforte 1997) to analyze the markets and agro-industrial dynamics of the quinoa production to consumption chain in Bolivia, Ecuador, and Peru. His report provides a description of the most important determinants affecting the growth and development of quinoa as a commodity from the perspectives of producers, processors, exporters and local distributors. For most producers on the *altiplano,* quinoa is still a subsistence crop, a product to trade for other foods in local markets or to sell to merchants for a bit of cash. This grain then goes into the national market or finds its way into both the formal and informal regional export markets in Peru. Although export markets are seen by many as of great potential, because of the image of the crop as the "grain of the Incas",these are still relatively small, take only a limited amount of overall production, and exert demanding conditions which are hard to meet consistently. Internal markets, on the other hand, are strong for various kinds of quinoa and easier to enter and develop.

In the five years between 1992 - 1997, important changes were recorded in the marketing of quinoa. There was a substantial increase in consumption of quinoa by higher income consumers. The spread of supermarkets and new firms processing, packaging and distributing quinoa in the main cities augmented its quality and availability. Bolivian exports expanded significantly, principally to Peru but the USA also grew in importance as an importer. The problems of production remained the same however, with no great changes in technology and still facing limitations impeding growth in productivity and area cultivated.

The conclusions reached by the consultant, and his recommendations regarding research needs, focused on improving production technology along much the same lines IDRC had supported in the past. Improvements could be made in processing and the development of new products but, given current demand, the main bottleneck is production. He observed that IDRC is one of the institutions most noted for its support of quinoa development across a range of topics including nutritional value, new varieties and technical assistance in both production and processing. This work contributed to greater technical knowledge of the crop and related production systems, the creation of a germplasm bank, an understanding of the agronomy of the plant, and by drawing attention to its value, contributed to increased demand and consumption. An indirect result of the work on quinoa has been the development of an agro-industrial and commercial structure in that many firms, both formal and informal, now process, package and distribute the grain.

In spite of all this, there is still a lack of available knowledge on the problems of production under the various agro-climatic and economic conditions encountered in the *altiplano.* Proof of this, Conforte claims, is the fact that production has not increased despite growing demand and high prices for quinoa. IDRC should therefor focus its support, he concludes, on research organizations dealing with technical improvement of quinoa and the testing of that technology under farm conditions. Quality research projects in these areas would have the greatest relative impact for dollar invested in quinoa development. This conclusion assumes, of course, that there is untapped potential in

technical solutions and their introduction to large numbers of subsistence producers. The reports of Estrada and Risi place more emphasis on environmental limitations and issues of production organization and incentives to increase productivity and lower costs.

4.1.4. Highland Farming Systems (Bolivia) (91-0005)

Experience in more integrated projects in Peru and Colombia seemed to demonstrate that a more holistic approach was needed to achieve improvement in small farmer production systems and research organizations needed to be fully committed to that specific task. With the advent of the World Bank support for its quinoa development and promotion program, IBTA, which now recognized a need for a more integrated approach, requested IDRC support to expand its experience in this approach.

A project was designed partially to intensify the quinoa cropping systems work, to draw in the Animal production systems aspects and include socioeconomic research and post-production aspects. Possibilities were considered for development of complementary activities with other Bolivian institutions and support from other IDRC programs. Linkages were promoted with a number of other IDRC supported projects and networks including: Animal Production systems Network (RISPAL); FSR Methodological Network (RIMISP); Andean Pastures Network (REPAAN); South American Camelids (Peru); Quinoa Production/Processing (Ecuador); and, Guinea Pig Production Systems (Peru) II.

There is no evaluation of the effects of this project but a summary of the technical work undertaken in 1995-1996 (Bolivia. Instituto Boliviano de Tecnología Agropecuaria), when the project was winding down gives an idea of the outputs. Most of the work seems to have been of good quality and was organized in a series of sub-projects involving research and technology validation on-farm in peasant communities. By 1996, only one technician remained essentially to work on writing up final reports of which three were completed, one for each of the major *altiplano* zones, North, Central and South.

In the south, the most arid zone of the *altiplano*, the need for more efficient use of scarce irrigation water was identified as a need for the production of faba beans, barley and vegetables for family consumption. A type of simple, cheap, drip irrigation system using materials available locally was adapted and introduced to producers by the project. Dissemination was facilitated by another project, "Proyecto Quinoa Potosí" which provided loans for the materials for demonstration plots and offered a prize for the best managed and productive system. The winner was required to demonstrate the techniques and their management in other communities in the area.

Other technologies tested and introduced included mass selection of quinoa seed by farmers to improve the quality of the seed planted. Adopting farmers reported increased yields and greater resistance to frost. A farmer identified problem, soil fertility deterioration associated with increased quinoa production, was the theme of a student thesis. Another student thesis characterized the structure and management of family llama herds and developed a computerized model to optimize husbandry practices under farm conditions. The results were to be provided to institutions working with llama producers.

Forage production and selection of forages with frost tolerance were studied in areas of severe frost risk.

In the Central *altiplano* studies were continued on the utilization of salt tolerant plants as forage. An area of 5000 ha where these plants could provide forage for animals was defined by CONDESAN partner ABTEMA based on satellite imagery interpretation. In more favored areas, communities keep milk cattle but because of their dispersion over wide areas, collection of the milk remained a problem. In response, the project developed a simple cooler to rapidly reduce the temperature of the milk so it could be held without deterioration for up to 48 hours. Testing of a range of forage varieties for adaptation under local conditions and management techniques to prolong production from alfalfa fields was another element of collaborative activities with farmers.

In the North zone of the *altiplano*, given its proximity to the city of La Paz, more intensive productive methods and market oriented crops were tested. Most popular with farmers was the simple drip irrigation system already mentioned and improvements to its reliability. The technical assistance department of a local university disseminated the technology in 11 peasant communities in the area. Introduction of and improvement in management of vegetable production in small greenhouses oriented to the La Paz market as well as family consumption were important products of the project. Technical optimization of the latter and related market research was continued in the Binational Resource Management Project (CIP\CIRNMA) in 1997 (96-8761).

This "systems" approach entailed greater and more direct communication with producers in their environment bringing to them a variety of technological and management possibilities from other areas and experiments. Not all of these possibilities proved useful but only by screening out the obviously unsuitable against local conditions and farmer preferences can appropriate alternatives be identified. There was no obviously direct and widespread impact from this project and critiques of the work imply that the on-farm work was not rigorous enough , especially that dealing with frost resistance in quinoa. However, there is evidence that bits and pieces of the work have been incorporated by farm communities into their practices and other intermediary organizations have been promoting relevant aspects of the work. A number of technical bulletins on the most promising technologies were produced and distributed. Ten student theses were completed with support from the project and technical results were documented. In terms of collaboration, seventeen national organizations, among them universities, NGOs, farmer organizations, government agencies and others are listed as involved in some form of coordinated activity either in R&D or in dissemination.

It was not possible to verify or further document these claims within the context of this study. IBTA has been disbanded and activities were widely spread. However, one of the authors of this study (Weber, 1998) had opportunity to discuss what role IDRC had played in introducing a broader systems perspective into Bolivian agricultural research and training systems with the project director, Ing. David Morales. His response was clear and direct. For a considerable time there had been resistance on the part of Bolivian agricultural researchers to any move away from standard research practices and direct input or participation of farmers in the research process. He himself had been very

skeptical but eventually became aware of the importance of considering broader interactions and the direct involvement of farmers and communities in the search for improvements to their production systems. Once convinced, he became a promoter and remains a strong proponent of the broader systems approach. He was emphatic about the influence IDRC support had through its support for the projects described here and the exposure this afforded Bolivian researchers to interact with their peers in neighboring countries who were dealing with similar environments, commodities and cultural practices. The impact was twofold: one, a better understanding of and improvements in traditional production systems and, second, training of a substantial number of young professionals with a stronger sense of system interactions and the need to communicate with farmers and value their views in the design and testing of potential production improvements. Ing. Morales maintains an association with the National University where he gives a course on agricultural systems.

4.1.5. Some final observations

What conclusions can we draw from this experience starting with a focus on a singel crop in Bolivia? It appears that IDRC financial support and technical accompaniment has resulted in a solid set of concrete results reaching well beyond the confines of the original grantee, IBTA which no longer exists per se. Technical results and accompaniment were shared with a whole range of other development groups and organizations. Other funding and R&D organizations entered the arena and a national quinoa development and promotion program was created. Improved varieties were released along with agronomic management recommendations. A better appreciation of the ecological niche environments where quinoa can be grown is available. The special needs of peasants and their communities as they relate to production potential have been documented and form part of the knowledge base. Many young researchers and peasants have received relevant training in production systems. Is this a sufficient contribution from IDRC that can now be left to others to build on, especially local organizations and interests?

It is interesting to note that, while IDRC has moved away from this specific type of technical research support, a need and a potential for impact is still strongly perceived for the same kind of work, albeit focused in a more integrated synergistic way. Should IDRC not have encouraged this focus more strongly from the beginning? In a way it did, but conditions are now quite different. Quinoa has evolved from being solely a subsistence crop grown by indigenous communities to holding the status of a minor commodity with expanding national and international markets. In order to exploit the opportunities of this market, however, the methods and organization of production require further change. This change will continue to move away from subsistence methods toward commercial production.

In the meantime, on the large number of small plots cultivated by peasants in the northern *altiplano* not much change has taken place in quinoa production. The new varieties and practices have not been widely adopted and many of the problems and solutions remain the same. Some of them are agronomic - better soil preparation and fertilization, water management, or integrated pest management. Others are genetic such as incorporating mildew resistance, frost and drought resistance, higher yield potential, and special grain

quality characteristics. Still others depend on tipping the balance toward the market and commercial production as opposed to mainly subsistence. Current improved varieties do not respond to all these requirements in the small plot and harsher conditions context.

The IDRC objective of helping the poorest under the most difficult conditions seems not to have been fulfilled, at least, not directly. Most of the impact seems to have been indirect and achieved through the initiatives and activities of a range of other organizations and by decisions of peasant farmers where they saw economic opportunities. In the future, new opportunities may be created through other alliances. Is there a stronger role now for the private sector to play and for the application of modern biotechnology? Is there a role for IDRC to help define and determine the R&D agenda in areas where market forces will not enter but which could help ease the transition from subsistence to commercial production? One channel for exploring the complexities of this transitional time could be through CONDESAN promoting an agenda of interaction between public and private partners working on similar problems in various contexts. Is there an opportunity for Minga with its multi-stakeholder agenda to explore how the various actors could more quickly and productively be brought together to serve the small producers interest within the growing market context? Clearly a challenge still exists in this arena from which more could be learned about the complex set of interactions involved in moving from a static subsistence to a more dynamic market economy.

4.2. Projects in Peru

4.2.1. Pasture Management (Peru) (76-0144, 80-0058)

The first production improvement project in Peru was approved in mid-1977, soon after the Quinoa project in Bolivia began. The project dealt with Andean pastures rather than crops and was carried out by the National Agrarian University, La Molina (UNALM) based in Lima. On-site research was carried out in one of the recently created SAIS, or cooperative enterprises, operating on agrarian reform expropriated lands of a former extensive cattle ranch *(latifundia*) in the S*ierra* about 370 km from the university. A senior Canadian forages specialist from McGill University assisted in the initial experimental design of the project and continued to advise the Peruvians as the project progressed.

A second phase of this project was begun in 1981 based on the assessment that the first phase had shown greater potential for improved pasture production than expected. By its very nature, this kind of research requires prolonged periods of testing and observation. The continuation also sought to consolidate the dissemination of the technology which had been successful at the original location to other SAIS.

In the final PCR (PCR 11/08/89), positive results were noted. Impact was achieved on the SAIS where work began initially through implementation of the improved pasture production technologies. These include improved pastures in irrigated areas and grass/legume mixes in non-irrigated areas. The technology also spread to other SAIS in the highlands. However, no impact was observed on peasant small plots even where some

of them were members of the SAIS. Most objectives were achieved but towards the end the inter-disciplinary focus successfully initiated in Phase I diminished considerably due to changes in leadership and internal difficulties at the university. In spite of this disintegration, the former IDRC program officer, Dr. H. Li Pun (personal communication), has emphasized that, through the IDRC supported Andean Pastures Network (REPAAN) (project 88-0188), technical results of the research were applied over a wide area in several Andean countries with similar ecological characteristics.

The project provided valuable institutional support to UNALM and its research program. Fifteen student theses in Animal Science were completed in the project and many other students received training within the project context. In addition, two professors from the Nutrition Department received support for M.Sc. and Ph.D. degrees at McGill University.

4.2.2. Andean Crops (Peru) I , II & III (78-0133, 82-0091, 86-0124)- PISCA

Project development in Peru proved much more complicated and drawn out than in Bolivia and it was only by mid-1979 that the first project grant was approved. Initial contacts with researchers in the main Lima based institutions indicated that their orientation and interests did not correspond with the on-farm type project IDRC was looking to support. Researchers were willing to travel to sites in the mountains to collect data and supervise students but none were located in the target region nor had interest in moving there. As a result, contacts were sought and established with researchers in three regional universities in the Departments of Ayacucho, Cusco and Puno.

Developing viable working relationships with the regional universities was a difficult hurdle to be overcome. The universities had no mechanism to receive and administer foreign exchange and their administrators were unfamiliar with the complicated procedures for submitting official proposals and getting approvals from the Ministries of Finance and of Education. Nevertheless, proposals were prepared, discussed, revised and refined over a period of almost two years while simultaneously, efforts were made to identify a viable intermediary institution with similar interests and capable of dealing with the government and university bureaucracies all for a reasonable overhead fee. In the end, despite some differences in objectives and views, the Inter-American Institute for Co-operation in Agriculture (IICA) with its international organization status turned out to be the best facilitating partner. IICA had laid the basis for the next important step toward work focused on a more integrated understanding of crop and livestock production systems (Tapia 1996) in the High Andes and its project leader, Dr. Mario Tapia, became available for the coordinating position included in the proposal to IDRC to facilitate and link activities in the three universities. Locally, the project came to be known by the acronym PISCA, for "Proyecto de Investigación de los Sistemas de Cultivos Andinos».

By the end of the first phase in 1982 (PCR, 05/18/89), the project was active in eight communities representing an ecological and socioeconomic cross-section of Andean communities in southern Peru. The main accomplishments include published descriptions and characterization of Andean highland production systems, agronomic experimental results recorded both on-station and on-farm, and training of students and farmers. Five professionals from the three universities were completing M.Sc. Degrees at UNALM and

24 scholarships were provided to support student thesis studies in the collaborating communities. Field days were organized regularly for community members and information and guidance was provided to school teachers in the communities. Farmers were brought to the university experimental stations to observe and assess trials underway, inter-community visits were arranged for farmers to exchange information and experiences in their own way with their peers and to demonstrate field results in their communities. An important IDRC arranged exchange involved exposure of the project leaders to the FSR research methods and practice being developed at CATIE in Costa Rica. This was to prove an essential experience for them to see and learn first hand from researchers in an already well established systems oriented program.

The project was really three projects in one tied together by joint planning and review meetings, exchange of written reports, and training activities. Results were achieved in the face of formidable difficulties. These included limited experience of most researchers and lack of contact with other institutions and researchers working on FSR, isolation, poor administrative support, primitive living conditions in the field, and an extremely complex research challenge. In many ways, the results exceeded expectations and the alliances and mutual confidence established between university researchers and the communities were of a high order. The project was judged to have more than met expectations and a second phase was considered following closely on the results achieved and knowledge gained from the initial experiences. Because the universities' ability to promote their results was limited, efforts were made to link with the Agriculture Ministry and other line development programs.

IICA was again the official recipient and administrator of the grant while involvement of the 3 universities in Ayacucho, Cusco and Puno continued. Soon after initiation of the new phase in January, 1983, however, the rise of the Shining Path movement in Ayacucho made field operations in that area untenable and the project moved this component to a new site, communities in the Coporaque District of the Colca valley in the Department of Arequipa south of Puno. This required an additional characterization activity which was completed by the end of 1984 and published. Activities were broadened from single crop and crop combination studies to include interactions between common production to consumption chain activities. Agricultural technology research continued to dominate and studies and continuing weakness was observed (PCR 05/18/89) in the design and analysis of specific interventions and in the application of project generated information and recommendations.

In 1985, IICA initiated an evaluation of the PISCA project referring to it as "The agricultural systems in peasant communities project" because of the modifications and evolution which had occurred during the process of its execution (Tapia 1996) 106. The IICA specialists who carried out the evaluation from an IICA perspective reached their conclusions after reviewing documents in the IICA Lima office and visiting the PISCA sites in Cusco and Puno. There is no mention of Ayacucho in the conclusions and recommendations. A summary of the main conclusions in the report (Instituto Interamericano de Cooperación para la Agricultura 1985) are as follows:

- The project made notable advances in Puno, Cusco and Arequipa in that order. In no case, however, was the level of development or the achievement of objectives sufficient to assure future stability of the introduced activities and structure.
- The impact of the project for the participating institutions was highly positive. The universities were able to incorporate new material into their curricula involving training in Andean production systems, upgrading for professors and students, and facilitating related thesis studies.
- In general, the project contributed to knowledge of Andean production systems, the development of the participating communities and constituted a base for the design of the recently created (1985) National Program for Andean Crop and Livestock Production Systems in INIPA.
- There is a clear predominance in activities focused on crops and livestock over those of socioeconomic orientation such as the *problematique* of the communities, their organization and development, their needs and strategies for working in communities.
- Project documentation does not reflect the magnitude of all the work accomplished nor does it illustrate the effort, interest, and spirit of dedication of the technical teams.
- The predominance in field studies of system components was noted as opposed to systems as a composite of interrelated components and their context.
- Training of the technical teams needs to be intensified in systems methods, principally in aspects of fieldwork management, and interpretation and analysis of information.

This summary of selected conclusions and recommendations in the IICA report confirms many positive results of the project and points out important weaknesses. At the same time, some observations reflect the difference in perspectives of IDRC and IICA regarding project management and leadership. IICA viewed the project as its own initiative led by a technical specialist in its employ and IDRC as the funding agency. IDRC, on the other hand, viewed IICA as an administrative conduit for channeling funds to its perceived recipients and partners, researchers in the regional universities with which it sought a working partnership. Fortunately, at an informal level, these differences were not allowed to detract from project activities and in the end, much was achieved that neither organization would have accomplished independently.

As will be described more fully below in the section on Twenty Years of IDRC Support in the Andes, the PISCA project set the stage for many activities carried out and funded by a range of development organizations and NGOs without direct IDRC contact or participation. While it is impossible to claim direct impact, many observers credit IDRC with helping bring attention to the needs of indigenous Andean agricultural communities and the complexity of addressing those needs from technical, cultural and economic perspectives.

As in Bolivia, the third phase of the PISCA project was conceived with a broader scope as reflected in its title, Andean Crops/Livestock Systems (Peru) III (86-0124) known by its Spanish acronym PICASA. The project responded to the need to bring together results and research teams of earlier work in both Andean crops and animal production systems. It also entailed a different set of organizational alliances by providing support to the

Universidad Nacional San Agustín de Arequipa (UNSA), the Universidad Nacional San Cristóbal de Huamanga, in Ayacucho and the government agency, Instituto Nacional de Investigación y Promoción Agropecuaria (INIPA) through its regional branch, CIPA VII, with direct support from a new INIPA national program on Andean Agricultural Systems. IICA did not participate in this partnership and funds were channeled through a non-profit foundation created by several agencies to administer R & D project funds.

The project was also to interact with other IDRC-supported activities including:
Getting such a wide range of institutions to work together on a broad list of topics was a challenge. Research and development work included site characterization, improved irrigation systems and agronomic practices, testing new plant materials, promotion of rotating seed funds and community nurseries, diagnosis and treatment of parasitic infections in animals, crop by-products for animal feed, evaluation of native pastures, selection of improved llama and alpaca breeding stock, training for community members and renewal of germplasm of native species. With all of this, the project as conceived was too ambitious and was judged to fall below achievement of its overall objectives (PCR 24/07/94). An FSR focus was not fully grasped by the researchers in INIPA and UNSA who always interpreted it as on-farm trials with farmer participation at a medium to low level. The overall level of agricultural systems research in the participating organizations did not change very much despite clearly improved capabilities of researchers directly involved in the project.

The recipient's management of the project was unsatisfactory with delays in making funds available to researchers negatively affecting the outcome of some experiments. Two public sector strikes affected project progress as well. Local jealousies and competition between institutions proved too great to overcome and the mix of university with national agricultural research institutions did not work. The financial situation at both organizations was so poor, and personal competition and animosities so great, that continuous conflict over resources resulted.

Nevertheless, in some areas of the Colca valley, the project achieved improvements in crop and animal production. The training objective exceeded expectations as did the conservation and evaluation of indigenous root-crop germplasm in Ayacucho. Both INIAA and UNSA published a variety of brochures and reports. Contact with other IDRC supported projects such as Andean Agriculture Network (RISPAL) (85-0256) and Andean Farming Systems (Peru) (84-0193), the PISA project funded by helped orient and reshape the project activities and strengthened it through provision of training and guidance in methodology. Two M.Sc. Scholarships at the Agrarian University, La Molina were granted to selected project technical staff; and two project staff members participated each year in regional or national meetings of relevance.

4.2.3. Andean Crop Post Production Systems (83-0209, 88-0023, 87-0334)

Parallel to the PISCA projects, and in an attempt to explore and develop opportunities beyond those only related to production in the production to consumption chain, the Post Production Systems Group of the AFNS Division supported several processing and marketing projects. The first of these, *Andean Crop Processing (Peru) (83-0209),* was

contracted with IICA, the official recipient of the PISCA project, and was managed by the same coordinator and mechanisms. It augmented post harvest research already being carried out by various university researchers at the universities in Cusco and Puno and was to be complementary to, and integrated with, the farming systems work. Overall, the project sought to develop improved techniques and systems for the harvesting, preservation, and processing of native grains and tubers in Andean farming communities. Activities followed the normal pattern of survey and documentation of current practice in rural communities, identified problems as a means of setting technology research priorities, developed and tested simple equipment to improve efficiency of existing processes and established test modules in two communities to incorporate direct participation of anticipated end users. Much of the focus was on activities in the universities, however, in an attempt to expose both professors and students to realities in the communities and applied post production problem research as well as encouraging the development of related curriculum content. Highlights included thesis studies by eight students in Cusco and Puno and a raised profile for post-harvest technology and management in the Andes through the First National Seminar on Andean post-harvest issues held in Puno.

In a follow-up project, *Andean Food Processing (Peru) (88-0023)*, staff from the universities in Cusco and Puno were joined by researchers from the two universities in Arequipa now involved in the PISCA project. Not only was the earlier work continued, but it was expanded in area and to other crops and animal products for nine communities in three ecological zones of southern Peru. Echoing the PISCA project experience of establishing community service centres as a focus for project interaction, small service enterprises were promoted in selected communities of the new areas of the Colca valley in Arequipa.

Benefit was expected to arise from experience in the earlier farming systems projects, links with the CIDA funded PISA project in Puno (see below) and the dissemination of results through the National Institute of Planning Microregions project promoting rural development in seventy microregions of the country. There is not much evidence that this broader scale direct influence or links to this project actually materialized. According to the project PCR (05/93), however, there was evidence of impact in the collaborating communities though the extent and significance of this is questioned in a comment by the ENR division Director. Adoption of improved practices included the use of rustic stores for better seed potato and grain storage and better cheese and dried meat production techniques. Through the establishment of several successful small enterprises, more hygienic standards for food processing and other services were provided in three communities. Changes in production and consumption patterns were observed related to value-added processing, exchange outside the community and organization of community storage. More than twenty training courses and workshops were organized with community members.

Extensive market description studies were done but the economists engaged to do this work were not adequately familiar with market research approaches and how to use the collected information to identify new opportunities. Monitoring of changes induced by the introduction of new practices and technologies such as nutritional impact, income

generation and impact on women's activities appears not to have been carried out. As in many projects involving relatively inexperienced personnel, the team experienced difficulty in applying a systems methodology in the areas of market research, community organization and evaluation of micro-level changes and impacts. The implication seems to be simpler projects with fewer research topics, identification of a problem to which a technology solution can be applied and follow-up assessment of impact. It was demonstrated, however, that even with the weaknesses noted, researchers in relatively remote and unsophisticated organizations were able to promote establishment of small food enterprises and adoption of improved technologies.

Mention should also be made of the networking linkages facilitated PPS with the IDRC supported project at the University of Manitoba, *Andean Foods (Manitoba/Peru) (88-1048),* and projects in Ecuador, Quinoa Processing *(Ecuador) (85-0213),* and *Quinoa Production/Processing (Ecuador) (90-0160)*. The coordinator of the project, based in Arequipa, subsequent to the project went on to establish a private quality standards laboratory in Arequipa and an organic products enterprise. These latter initiatives are described further in Section 5.

Although there were many situations where women participated in production and post production training courses and other project activities supported by IDRC, in all the projects reviewed, only one small activity deals directly with the role of women. The project, *Women and Andean Post-Harvest Technology (Peru) (87-0334),* was a joint activity of the AFNS division and the Social Science division's Women in Development program. As part of the above described food processing project, improved technology for milling grain and for baking was installed in two communities in the Puno region. Many post-harvest activities, as well as food preparation, are undertaken by women so the research team sought to assess the changes brought about by the introduction of new technologies and their impact on the activities of women and their families. The study showed a positive effect from the introduction of a stone mill in one of the communities to the extent that members of a neighboring community also came to grind their grain at the mill. An increase in area planted to grain was noted the following year and commercial flour purchases were reduced. The bakery established in the second community was less successful at generating wider participation and change as it was controlled by a single family. In spite of the objectives of the project, impact on women and their activities was not clearly documented but it was mostly men who took up the introduced technology (28, PCR.87-0334, Oct, 1988). While there were likely indirect effects on the work and tasks of women, both positive and negative, these were not assessed.

4.2.4. Andean Farming Systems (Peru) (84-0192, 92-8762, 96-8761) PISA

a) Background

Beginning in 1973, CIDA had responded to Peruvian interests in augmenting domestic edible oils production and in stimulating agricultural development in the *altiplano*. The original project centered on the introduction of canola as a cash crop alternative to other crops traditionally produced by farmers. CIDA support was designed around strong Canadian participation and management of the project. It created new research-station

and training facility infrastructure and operated somewhat independently from national institutions. The project faced many difficulties related mainly to fluctuating Peruvian interest and support as well as to the difficult natural environment. Unpredictable frost and drought occurrences resulted in poor adaptation of the limited range of canola germplasm material introduced. In the second phase of support, winter wheat and barley were included and selection of introduced plant material along with better agronomic practices was more successful. An evaluation of the project in 1981, during Phase II, recommended that CIDA continue to provide support in order to achieve dissemination and wider impact of this research work. How the new materials and related production practice recommendations would fit into existing cropping systems in the three ecological regions of the *altiplano,* however, was not addressed.

Subsequent to a Peruvian request for continued CIDA support in 1983, CIDA reviewed its project implementation strategy and, wishing to escape from operational responsibility for the project, began a search for an external executing agency. Given the focus on research, an external review team identified IDRC as the best choice given its capability in managing this type of activity and its knowledge of the region. A joint IDRC-CIDA mission visited Peru in 1984 to define overall parameters and subsequently INIPA and IDRC finalized a project design for the further phase of CIDA support. With a budget of $5.05 million, including local contributions, and activities programmed for a period of 5 years (1985-1990), this was a much larger project than normal for IDRC and differences with CIDA over style of management and expectations had to be confronted from the beginning. At the time of the inception report in 1986, IDRC backed a Peruvian request to extend project life to seven years in order to include major extension efforts judging that the disbursement rate was such that this would be feasible within the approved budget. This request was denied by CIDA pending a mid term evaluation carried out in 1988 (Canada. Canadian International Development Agency 1989).

b) The institutionalization challenge

Initially, the project was implemented as a regular IDRC activity where the Center relied on the national organization, INIPA, to take the main responsibility for management of the project. This was within IDRC strategy which assumed that insisting on grantee project management would facilitate incorporation of the project content and approach into relevant programs and activities of the grantee organization, in a word, institutionalization. CIDA, on the other hand, expected a more hands on management style, and in some quarters, closer adherence to the prior CIDA project content and approach. While agreed objectives between the three collaborating institutions emphasized "institutionalization" of a farming systems research approach, views on how that would be achieved differed and appreciation of the potential difficulties of implementing the implied changes were underestimated.

The leader of the project and some research staff came from PISCA and brought with them a research approach developed through university collaboration which involved part time participation of many university staff in various components. PISA, however, within the context of INIPA and CIDA project expectations, was designed to be executed by a team of full-time professionals involved in on-going research programs at the regional branch, CIPA VII. These programs normally responded to directives from the national

commodity-based programs based in Lima. The result was conflicting strategies and fund allocations. There was no niche in INIPA to accommodate an inter-disciplinary, multi-commodity project such as PISA even though a National Andean Crop and Livestock Production Systems Program (PNSAPA) had been created within INIPA and PISA was officially part of that program.

Tapia (Tapia 1996) 107 describes how the creation of PNSAPA in 1985 was facilitated by the establishment of PISA. Attempts were made in this program to involve other sections of INIPA in studies of prototype areas through arrangements with donor supported projects in four regions: Cajamarca, Junín, Cusco and Puno. In Cusco, the regional CIPA hired an extensionist to continue the work initiated by PISCA in the original four communities and, in collaboration with a project supported by Germany, promoted Andean crops in a number of other CIPA/INIPA agencies in the region. In Puno, of course, the link was through the PISA project. The other two regions were linked with UNEP and World Bank funded projects respectively. With the reorganization of INIPA in 1987 when it became INIAA, PNSAPA was replaced by a series of new programs focusing on components and crop and livestock system studies were relegated to the agricultural economics program. This resulted in very little interaction between programs .

Through PISA, experimental work was conducted in eleven different communities. Much of it was similar to that conducted on-station with a strong focus on potato, quinoa, kañihua and barley. Much less attention was paid to other cereals and canola prompting criticism, as noted above, from some quarters at CIDA. While the project set about establishing an FSR approach to its research program and a great deal of data was collected and structured into a number of databases, little in-depth analysis was undertaken. Links were not established between results of current experiments and surveys and the planning of the next season's research. This resulted in experiments relating more to INIAA's national commodity program focus than to integration of feedback from community needs analysis. It also led to the project concentrating more on crop than on livestock research activities even though under *altiplano* conditions, livestock is an important part of peasant agriculture and family income security. In terms of staffing, PISA experienced substantial turnover of research and community-based personnel. This limited the possibilities for integration of the different activities into a cohesive FSR approach and understanding.

In spite of these weaknesses, a wide range of training activities were undertaken for both staff and peasants. Four INIAA staff received support for graduate studies and many others received short course training in a variety of areas. Many community training events were organized dealing mainly with crop production and involving a roughly equal balance in participation between men and women.

The mid-term evaluation concluded that PISA had achieved little in terms of developing crop and animal production systems suited to the project communities because of a weak implementation of an FSR approach. The reasons for this lack of progress toward achieving project objectives were noted to be: project inability to attract and retain staff; the lack of integration in research planning and development between INIAA and PISA;

and, lack of experience in existing FSR methodology and its application. It was noted that because of its size and complexity, the project merited greater IDRC attention in terms of monitoring and guidance despite the hiring of a liaison officer specifically to assist in this function. On the other hand, PISA/INIAA seemed to have ignored most technical recommendations made to the project by IDRC. It was suggested that IDRC should provide more support to institutional development in INIAA to improve the likelihood of achieving project institutional objectives and that INIAA reporting systems should be a focus for IDRC guidance. Noting the weakness in social science research in the project and the fact that IDRC was emphasizing interdisciplinary research activities in its own programming, it was suggested that LARO explore ways of incorporating involvement of the then Social Sciences Division in the project. It was also indicated that IDRC reporting to CIDA needed to be improved in timeliness and content.

The above comments have been selected from a large number of analytically critical observations made by the CIDA External Review Team to illustrate how difficult it is to conduct long term studies and develop viable improvements to complex integrated production systems. While IDRC agreed with most of the analysis and critique of the project implementation up to early 1988, an explanatory note from IDRC Senior Program Officer Dr. Hugo Li Pun to the review Team leader (Li Pun 1988) set out some of the mitigating circumstances suggesting that these were not adequately addressed in the review. Without going into detail, these included an explanation of how the instability of national, local and institutional environments affected the operation of the project in comparison with original assumptions and expectations.

Economic conditions deteriorated rapidly and exchange controls and inflation played havoc with budget management and with attracting competent, experienced staff. In several of the communities, security became a problem necessitating withdrawal of staff without completing studies. The National institution was changed from INIPA to INIAA transferring promotion components to the Ministry of Agriculture and dividing infrastructure, staff and budgets. The most highly qualified Peruvian staff took on administrative positions bringing into question the feasibility of IDRC and INIPA intentions of staffing the project solely with Peruvian nationals within the INIPA structure. INIPA/INIAA had four different directors over less than three years and the same situation was experienced in CIPA VII in Puno. Short-term pressing needs, lack of clear direction, and the large number of projects funded externally by other donors diluted local resources and made any efforts to institutionalize an FSR approach all but impossible. These conditions were exacerbated by two long public sector strikes which paralyzed research, development and bureaucratic support activities.

In spite of these difficulties, the project still managed to function and make some initial contributions both in the communities where they worked and in providing training and technical exchange opportunities as well as in facilitation and promotion of integrated program activities.

c) Response to the mid-term review recommendations

It was obvious that IDRC and INIAA had to take steps to respond to the criticisms and recommendations of the Review Team. IDRC quickly took decisive action and shifted its

collaborative partnership strategy to assume an assertive management approach more in line with CIDA expectations of an executing agency. Over the next six months, a new project leader with a strong track record in FSR and several experienced social and biological scientists were recruited and directly hired by the project. Work was concentrated in five communities representative of the major ecosystems of the region. A strong focus on systems diagnosis was implemented and specialist consultants in specific fields were called upon, especially in the area of systems simulation and adoption studies. Most of the less defined promotion and interactive work with farmers was abandoned in favor of the more technocratic and analytical approach called for by the Review Team.

One of the recommendations had been a second review towards the end of the project to assess how CIDA should respond to the original IDRC/INIAA request for extension of the project. This request was for a further two years, using residual unspent funds, focused on the consolidation of work underway and the preparation of a plan and proposal for a results application and dissemination phase. Two of the original Reviewers, including the Leader, and a representative of INIAA carried out this second review in May and June, 1990 (Thomas, Cotterill et al. 1990). Their conclusions were dramatically different from the first review as reflected in the following statements:

- "The Team found a project considerably stronger in staff and research approach compared to the time of the mid-term evaluation. Of particular importance was the degree to which systems concepts had been developed, and were being implemented at the community level"
- "As a result of decisive action by IDRC and INIAA, the project now has a resident team of extremely high quality. Practically all of the recommendations made in 1988 have been adopted. There is an increasing emphasis on livestock research and a clearer overall focus on technologies which can improve beneficiaries incomes"
- "The PISA team has refined FSR methodology to the point where a logical and consistent process is being followed in the five collaborating communities"
- "While most of the period between 1988 and the present has been taken up with strengthening the PISA team and improving FSR methodology, there has also been progress in institutionalizing FSR capability in INIAA at the regional level"
- "The Review Team views the PISA research team as a powerful resource which has the potential to contribute to Peru’s agricultural and rural development well beyond the confines of the current project. INIAA increasingly recognizes the contribution that the project is making to assisting marginal agriculture in the region and to agricultural research activities in general"
- "IDRC demonstrates relatively unique capacity among Canadian organizations to execute a project of this nature, size and complexity. Working relationships which have evolved between INIAA, IDRC and CIDA seem to meet the needs of the project and the project continues to be consistent with the overall objectives of these organizations"

The Review Team recommended extension of the project for a further two years, as proposed, and suggested CIDA support a further dissemination phase planning for which should begin shortly. They also urged investigation of potential technology dissemination

mechanisms and arrangements with agencies and human resources necessary for development of these activities.

From an IDRC perspective, the major achievements of the project were:

- "Assembling of a high level research team capable of interdisciplinary analysis linking bio-economic and social aspects to fully understand Andean farming systems in order to propose sound alternatives for their improvement.
- the production of a stock of knowledge of Andean farming systems, to a large extent published and made available to policy-makers and development agencies.
- the development of methodologies for Andean systems analysis and for the identification of appropriate technological alternatives to increase welfare in a sustainable way.
- identification of a range of technological alternatives with potential.
- implementation of a successful revolving seed fund with the leverage to induce adoption of improved varieties through a range of development institutions.
- training of eight Peruvians at the MSc and one at the PhD level and about 20 other INIAA staff in research methodology" (Li Pun and Seré 1991)

In addition, several thousand farmers participated in training activities, more than half of these were women, and many students conducted their thesis studies within the project context. Project staff undertook consultancies to other R&D projects and applications developed in the project were adopted by projects in the region and other Andean countries. Two examples are described in the Case Studies of *Waru Waru* rehabilitation and Revolving Seed Funds in section 6.

The PISA project developed a concrete vision for a coherent development strategy in the Puno region. This encompassed both pasture based animal production (mostly alpacas) for export as a lead sector and crop intensification in the more favorable areas, notably around the shores of Lake Tititcaca, catering to growing local demand. Temporal and permanent labor migration was considered part of the process in order to relieve pressure on natural resources and contribute to capitalization of the regional development process. The vision incorporated gender and system sustainability issues and attempted to make these concepts operational.

Following on the recommendation of the 1990 Operational Review, CIDA approved the recommended two year extension to consolidate the work of the upgraded research team and signaled interest in providing continued support. The PISA team, along with INIAA and IDRC, began developing a proposal for CIDA support of an additional five year phase of the PISA project. A CIDA Agriculture Sector Mission visited Peru in March, 1991, and assessed the environment in which the PISA project had been implemented as well as future projections. Comments on the mission report by Centre representatives clearly indicated that they felt the PISA team was a unique resource in the region and that discontinuing support after slightly more than two years would be a costly mistake. The team’s task had yet to be completed and the results of their work disseminated to Puno communities as well as to others in similar Andean highland ecological conditions in Bolivia, Chile, Ecuador and Colombia (Li Pun 1991).

Its holistic understanding of farming systems in the Puno region gave the PISA team a unique comparative advantage in the assessment of potential solutions in an environment requiring more than isolated technological solutions. A clear demonstration of the efficacy of this approach, however, was still pending and the PISA team was anxious to continue their work beyond the initial diagnostic phase to demonstrate that a holistic FSR approach can better identify specific commodity systems with development potential on which to focus commodity-based technology research and development efforts. The next steps would still need to include some diagnostic studies but much more focused on specific alternatives linked to market and economic potential. The team was convinced that demonstrating this progression would make the integration of an FSR approach into INIAA fabric a more realistic and viable endeavor than one without tangible outputs. Although the PISA project had the objective of introducing FSR methodology into all INIAA units, as seen above, success in this intention was limited.

d) Sustainable Highland Agriculture (Peru) (92-8762) PRODASA

In the end, the project as conceived for continued CIDA support did not materialize. Budget reductions and shifting priorities within CIDA, as well as deteriorating conditions in Peru, resulted in a fairly abrupt indication from CIDA that they would not be able to participate further in the Andean research and development work. IDRC, however, made a commitment to continue, although at a reduced level of funding more in keeping with its available resources. About this time, a number of actors in Puno, mostly members of the PISA team, took a pro-active stance to development promotion in the region and, investing their own personal resources, formed a new NGO as a focus to carry on elements of the work initiated in PISA. This organization, Centro de Investigaciones de Recursos Naturales y Medio Ambiente (CIRNMA), came to serve as a mechanism for facilitating alliances and collaboration between many organizations, including NGOs, active in the Puno region and to play a leadership role in NRM oriented research and development.

CIRNMA, along with IDRC representatives, had also been involved in discussions with Dr. Hubert Zandstra, Director General of the International Potato Center (CIP) based in Lima, on ways to build on the PISA legacy. Within the international agricultural research center system, awareness had been growing that a strict commodity approach on which they had built their organizations was not sufficient to maintain support in a funding environment where concern for natural resources management (NRM) and sustainable systems had eclipsed agriculture and food as major priorities. Consequently, Dr. Zandstra was leading CIP in a major reorientation toward NRM and mountain production systems. He agreed with, and was interested in participating in, the kind of holistic research and opportunity identification research in which PISA and other IDRC supported projects were engaged. As part of a wider consortium of research interests (CONDESAN) explained below, CIP joined CIRNMA in submitting a proposal to IDRC to continue relevant parts of the PISA project and help keep the highly qualified PISA research team linked together. It was designed to focus on detecting and solving relevant problems in NRM and agriculture from community to micro-regional level within a national framework. IDRC approved support for the project in March, 1993.

IDRC too was undergoing major changes in its structure and programming at the time and this project was developed in the context of the new Environment and Natural Resources Division (ENR). An area of focus in the program in Latin America was the sustainable development of mountain areas which corresponded well with a similar mandate accorded CIP by its Board and TAC about the same time. In IDRC, there was a strong emphasis on entrepreneurship so project support was considered seed money and only partial funding was provided for core activities. To fully achieve objectives and obtain long term support, researchers and management were expected to negotiate additional funding from other agencies and donors active in the region. Some services to other internationally funded projects were to be charged a reasonable service fee administered through a special trust fund in CIRNMA and CIP. Within IDRC, joint activities were anticipated with the Social Policy Program in the areas of Human Resource Development for Sustainable Production Systems and Policies for Sustainable Rural Development. Externally, a long list of contacts with other donors and agencies were listed in the Project Summary representing opportunities for alliances through collaboration in activities or direct funding. INIAA was expected to collaborate in the implementation of the project by providing counterpart funds, personnel, experimental station facilities and equipment. A steering committee composed of representatives from CIP, INIAA and CIRNMA was formed to coordinate implementation and evaluation.

The results and impact of this project are hard to judge from documentation at hand. Certainly, CIRNMA has managed to survive well beyond this initial support and carve for itself an important and respected integrating and analytical role in the Puno region. It has been able to gain support for projects from a number of supporting institutions and become involved with the processing and export of Andean products, especially quinoa and alpaca fibre. The CIP/CONDESAN program has continued working in the region. Research results correspond with the objectives and indicate the potential benefits of adoption of various technologies by farmers under specified conditions. They do not assess actual adoption and impact. Many of the supporting needs were discussed with other agencies and projects active in the area and some of these show evidence of influence from the IDRC supported research. Attributable linkages, however, are weak or anecdotal which means the project must be judged on its research quality and selection of the development issues it tackles relevant to ultimate beneficiaries. In these it appears to have done well but one is still left to question what might have been achieved had more resources been available to continue the PISA project on to the planned development and dissemination stage and engage a wider range of local organizations in the process.

e) Binational Resources Management (Peru/Bolivia) (96-8761)

IDRC programming interests continued to shift away from FSR and agriculture technology work. Approaches from IBTA in Bolivia to continue the Highland Farming Systems project and from CIRNMA/CIP to continue PRODASA support were discouraged. Wishing to see some concrete results and operational verification of recommendations coming from the modeling efforts of the earlier projects, IDRC offered to consider a proposal focused on two of what the teams considered their most promising technology packages. Pressure from IDRC for more direct impact related to market strategies was a defining element and a project was organized to test and validate market-oriented technology, capitalization, and operational development options at a viable

economic scale. The overall approach included taking an integrated view of local markets in the context of the larger economies of the two countries and introducing technologies which ameliorate some of the severe climatic effects on production in the region. Two types of enterprises were proposed: intensive small commercial greenhouse production of vegetables for the markets of Puno and La Paz; and, feeding of cattle confined in rustic shelters with dried aquatic reeds from lake Titicaca.

The project got underway in mid to late 1997 and is currently coming to an end. Final results are not yet documented and an extension and major supplement were requested but denied by IDRC. It appears that the implementation of the technologies and development of markets for local products are more complex and require more time than was anticipated. A modest budget and two years to implement two production systems and develop a marketing system in partial competition with other larger scale enterprises was probably a bit optimistic. It would be useful to undertake a detailed evaluation of this final project to determine how much of the original expectations were achieved and document lessons which might be learned relevant to current IDRC programming.

4.2.5. Sustainable Andean Development: CONDESAN

CONDESAN represents an umbrella structure for a number of IDRC supported activities developed in the course of the Centre's evolution from a focus on small scale agriculture and food production systems to a broader concern for natural resource management (NRM). While CONDESAN covers all of the Andean region in five countries, only those projects based in Peru and supported through the International Potato Center (CIP) are included in this review. These projects include:

- Sustainable Andean Development (CIP) (92-8753), CONDESAN I
- Sustainable Andean Development Consortium (94-0014), CONDESAN II
- Sustainable Andean Development Consortium (97-8754), CONDESAN III
- InfoAndina (CIP) (96-0021)
- Policy Interventions in the High Andes (50215)

IDRC participation in the development of CONDESAN, more program rather than project support, has its roots in the experiences of the PISCA and PISA projects and the several production technology networks various IDRC sub-programs had been instrumental in establishing. These included networks related to FSR, crops, animals, post harvest and to some extent, policy. It harks back to various responses to Agenda 21 of the UNCED global environment conference held in Rio in June, 1992, and developments in the CGIAR system representing a conglomerate of donor agencies, research centers and international agencies.

a) Background in the CGIAR, IDRC and the Andean research community
By the time of the Rio conference, the CGIAR system had become very much aware of the limitations to high input "green revolution" agriculture, especially under the conditions experienced by the marginal farmers they claimed to assist. The system was expanded in 1990 to include centres dealing with irrigation management, aquatic

resources, agroforestry and forestry research. It also recognized the need to adopt a more balanced emphasis between biophysical and social sciences in «ecoregional» work, the need to adopt an integrated systems approach, and to link policy formulation to technology development. This paradigm shift in approach to agricultural development research has been a substantial challenge for the individual centers, as well as for the system as a whole, and is one which continues to evolve (Consultative Group on International Agricultural Research 1998). Ecoregional research called for closer collaboration between IARCs and with research partners in NARS and industrialized countries. CIP became involved in two of eleven CGIAR "system-wide" ecoregional approaches with a variety of partners: the Sustainable Mountain Development initiative, and the Consortium for the Sustainable Development of the Andean Ecoregion (CONDESAN).

Meantime, IDRC in its 1992 reorganized structure was emphasizing the socioeconomic and organizational aspects of rural development and the selection of technology options within an NRM context in its programming. This orientation required a strong holistic perspective of the natural environment, natural resources, their use, and related social and economic organization. As described in the background to this study, there had always been an orientation within IDRC toward a holistic or systems view, albeit mostly concentrated on understanding and improvement of agricultural production and related natural resource components. Now the challenge was how to bring these together, link with policy studies and concerns, and take advantage of new analytical, information and communication tools. Many organizations and activities in the Andes region were reaching the same conclusion and, on the initiative of CIP and IDRC, an international workshop on the Andean agro-ecosystem was organized and held at CIP in March, 1992. Interest was widespread and close to sixty specialists representing at least forty organizations, projects and programs participated, among them: NGOs; national agencies and programs; universities; donors; CGIAR centers; projects; and regional/international agencies from seven South American and five donor countries. The meeting was financed by IDRC, the Italian Government and USAID. Presentations at the workshop provide a good benchmark on what was known at the time and served to synthesize lessons from R&D experiences in Andean agro-ecosystems. Proceedings were published by CIP with financial support from IDRC (Centro Internacional de la Papa 1992).

Organizers and participants in the workshop alike were concerned with questions of where to go next in confronting interrelated problems of poverty, natural resource degradation and sustainable development in the Andean region. The outcome was a strong recommendation in the final workshop report that a research network or consortium, led by CIP, should be established to link all interested actors.

b) Evolution and support of CONDESAN

Given IDRC experience in supporting and promoting systems oriented research in the region and CIP’s new mandate for involvement in eco-regional research, participants in the workshop, backed by other donor representatives, requested IDRC to join CIP in the organization of the proposed eco-regional initiative. Other donors agreed to provide support for specific activities. The Swiss Development Cooperation, COSUDE, assigned US$5 million for five years to support conservation of Andean root and tuber bio-

diversity in CIP and national programs. Germany through GTZ and the University of Kassel collaborated in agro-ecological characterization studies and methodology. Dutch collaboration through Wageningen University was already underway. IPGRI promised support and involvement in bio-diversity and genetic resource work. ORSTOM of France linked in work it was planning on land and water management and agroforestry. Large bilateral projects supported by other donors identified areas of collaboration in which they would be expected to share costs. The process of negotiation and piecing together this consortium of interests continues to evolve up to the present.

IDRC direct support for the initiative came in the form of the Sustainable Andean Development (CIP) (92-8753) project funded from the Environment and Natural Resources Division (ENR) and the Latin American Regional Office. The objective was to organize a collaborative research and development program to promote the sustainable development of the Andean ecoregion, based on the appropriate management of natural resources. This was the beginning of CONDESAN, a regional program for the sustainable development of the Andean region. Participation was, theoretically, to be built on agreed upon objectives and the sharing of costs and responsibilities linked to the respective comparative advantages and abilities of participating organizations. It was felt that to achieve this ambitious undertaking, a core think-tank team within the program was necessary and would promote a more efficient use of resources. They would provide leadership, conduct analytical studies, identify key entry points and technically support a range of on-going R&D activities carried out by associated institutions and project teams. A list of 42 participating institutions was appended to the proposal received by IDRC.

Within two years, the CONDESAN structure was essentially in place and functioning. An Advisory Council, or Board of Directors, was formed, a Consortium Coordinator was appointed by CIP, the basic technical team was formed, a participatory program planning by objectives (PPPO) process was introduced, benchmark areas where work was to be concentrated were identified and technical and socioeconomic analysis was underway on priority topics. Part of the work included an inventory and synthesis of what had already been done and what was underway in the context of the many partner organizations. A proposal from CIP for continued CONDESAN funding in 1994 summarized the many activities and outputs of the Consortium in its first two years which, in turn, were built on previous experiences and on-going projects many of them IDRC supported. These activities were summarized under seven topics: coordination and general management; bio-diversity of Andean crops, pastures and animals; land and water management; agricultural policy and rural development; commodity systems; human resources development and dissemination; and InfoAndina communication network. In 1994, IDRC provided further financial support to facilitate consolidation of the CONDESAN endeavor.

In many ways, creating and facilitating the CONDESAN vision fell far short of its initial ideal. Every partner had its own objectives and focus and the coordinating group was strongly influenced by CIP directions and leadership. To monitor progress, and as part of the consortium development strategy, IDRC along with the CONDESAN Board, insisted on including a mid-term external review in the Phase II proposal. This review was organized by IDRC and jointly supported by IDRC and COSUDE. The latter organized a

separate technical review of the Andean roots and tubers biodiversity program (RTA) they were directly supporting.

An initial mail survey of CONDESAN members in early 1996 indicated a wide range of perceptions of the purpose of the Consortium. Many respondents expected it to be a source of funding for their own activities. Clearly the vision of a decentralized initiative and voluntary sharing of information and resources had not caught on. In May, 1966, an evaluation team of three reviewers met with a number of Consortium partners, visited benchmark sites and interviewed members of the CONDESAN coordination team, the Board and CIP (Mateo, Brown et al. 1996).

The review team concluded that CODESAN mechanisms and strategies were very promising with potential for positive impact in the Andean ecoregion through facilitation of focused, collaborative research. It encountered evidence of good quality research in various components and sectors, particularly in:

- ex ante evaluation (modeling) to provide a framework for research focus and component testing;
- further development and utilization of knowledge, methodologies and technologies generated by the PISCA and PISA projects in the Peruvian *altiplano*; and,
- the identification, characterization and conservation of Andean roots and tubers supported by COSUDE.

Support from a variety of donors for activities and projects associated with CONDESAN received positive mention by the evaluators and special note was taken of the substantial number of NGOs which were associating their development work with CONDESAN research interests. The importance of CIP's role in creating CONDESAN was acknowledged and its important function in providing an international home for the Consortium. Political support at local municipality, NGO and national levels was observed at the pilot sites and CONDESAN was seen as having the potential to attract and integrate financial and scientific resources to accelerate the research and development process and achieve multiplication effects.

On the negative side, the Review Team noted a «certain lack of transparency» in the relationship between CIP and other partners as well as in the use of financial resources under the CONDESAN umbrella. Various partners desired to see greater clarity with respect to available resources and to participate in the decision-making process on their use. This feeling did not apply to the RTA biodiversity initiative which was more predictable and focused in its programming and management practices. The identity, mission, objectives and structure of the Consortium was judged to lack adequate clarity and consistency in its definition and presentation. While a strong initiative had been mounted in projecting a CONDESAN image externally, and fund raising had met with some success, these efforts were observed to have taken away from the formation of a true working team. Insufficient effort had been dedicated to achieving a common vision and goals and to promoting exchange of information and communication between partners.

The evaluation team was very conscious that they were not dealing with an organization or network in the traditional sense. Constructed on the basis of a number of existing research projects and development initiatives, it was difficult for CONDESAN to explain and attribute accomplishments to any individual actor. The coordinating unit had limited resources and most funds were allocated to specific components of the overall plan set out in the PPPO framework. The challenge was to learn how to work in this kind of relationship through better communication and a willingness to interact and build alliances with a broader perspective in mind. An holistic approach to understanding development is a desirable ideal but difficult and long-term in its execution. The review team gave specific emphasis to the evolving role of InfoAndina as a core function and tool of CONDESAN initiatives and leadership suggesting that «it will be the unifying force for scientific development and policy exchange which can give even the weakest partner access to the current thinking of his peers within the national and international spectrum» (Mateo, Brown et al. 1996).

The eventual outcome of the review was a change in CONDESAN leadership and initiatives to achieve improved focus. InfoAndina received more support to become a central element in the operation of CONDESAN. To give time for the recommended changes to be put in place, IDRC support was supplemented and extended for an additional year to 1997. During this extension period, discussions took place regarding the possibilities for continued Centre support as well as content and level of funding.

c) Sustainable Andean Development Consortium (CONDESAN) III (97-8754)
To help keep the initiative moving along its evolutionary path, in 1977 IDRC agreed to an additional two year project with a substantial portion allocated to maintaining the functions of the central coordinating unit. In keeping with its reduced resources and changing orientation in programming focus however, the Centre was forced to reduce its level of support to CONDESAN compared to earlier phases. The main focus of this continued support involved three components:

- Strengthening of the CONDESAN partnership by support for the coordination unit; development of human resources through workshop training, M.Sc.
- Training and distance learning; and,
- Improvement of community based decision-making in the area of NRM.

With the arrival of the new CONDESAN coordinator in early 1998, the last two components were modified to focus on collaboration in the development of Andean Natural Resources M.Sc. programs, and the facilitation of research teams on priority resource management themes through a small grant mechanism. This project is ongoing but is having severe difficulties in attracting funding, especially for the coordination functions.

The coordinating unit has dedicated much of its time in 1998 and 1999 to preparing project proposals to submit to donors and to expanding and facilitating a much more open dialogue with CONDESAN members in general. A number of partners are working in the

areas outlined above, usually with funding derived on their own separately from CONDESAN but still associated with the Consortium. IDRC support to partners in Ecuador is one example of this arrangement. A wide range of research and training on sustainable NRM has been undertaken during this period and some innovative and dynamic experiments in social and market organization have been initiated in organizations from all countries represented in CONDESAN. Very highly technical and fundamental work is also being done, especially at CIP where a large part of the CONDESAN related funding resides. The challenge for the Coordination Unit is how best to facilitate sharing of information and participation in efficient and effective ways throughout the Consortium as all partners grapple with the science and complex interactions of sustainable and productive use of Andean natural resources.

In late 1999, it appears that CONDESAN is moving to a strong facilitation mode in which it participates more responsively in facilitating partner generated ideas and objectives and promotes communication between partners with similar interests. Infoandina has been brought into a much more central position in CONDESAN activities and is rapidly becoming the backbone around which the Consortium communicates and functions in a multi-directional manner.

d) InfoAndina (CIP) (96-0021)

InfoAndina was created to facilitate empowerment of researchers through improved capability in using information and communication technologies. This would allow more frequent and efficient collecting, analyzing, sharing and disseminating of data and information amongst CONDESAN partners in disadvantaged regions of the High Andes. Support for developing a more integrated communications strategy was first discussed with IDRC in November 1996 during the CONDESAN Annual Board meeting in Quito which endorsed the external Review Team's urgent recommendation to strengthen Infoandina. IDRC support complemented funds already allocated to CONDESAN by COSUDE for the purpose of initiating Latin American operations of the Global Mountain Forum in 1996-97.

The general objective was to reinforce InfoAndina as a reliable, easily accessible source of information on natural resource use in mountain agroecologies, focusing on services to CONDESAN participants where users would benefit from the exchange of ideas, databases, best practices and knowledge. Proposed activities included:

- collection and dissemination of information from CONDESAN benchmark sites in Bolivia, Ecuador, Peru and Colombia (subsequently, a site in Venezuela was added);
- assistance to researchers in the organization of their research data sets and bibliographic information in the areas of biodiversity, sustainable development and natural resource management;
- the development of technical capabilities in information management and exchange between benchmark sites and research centers;
- facilitation of researcher participation in electronic discussion conferences and groups organized by InfoAndina;
- development of the CONDESAN web site to host information and training events, thematic discussion lists, and electronic conferences; and,

- provision of wider dissemination of CONDESAN web pages to a larger audience via world-wide internet access, CD-ROMs and printed handouts.

InfoAndina has actively pursued a range of relevant activities and created a much broader ability and interest among its members in the use of electronic media for a broad range of R&D activities. A bimonthly electronic bulletin lists planned and past activities, publications and conferences. "InfoNotas" are bulletins covering specific topics prepared by CONDESAN specialists to update members about their results. A variety of seminars and training courses have been facilitated and personnel from benchmark sites trained in the use of the internet and creation of web sites. Electronic conferences have been organized and moderated by CONDESAN partner specialists on a number of topics including:

- *In-situ* conservation of bio-diversity;
- Conservation of *páramos* and *punas*;
- Local government and rural development in the Andes; and,
- Rural agro-industry.

CONDESAN web pages archive all the articles, comments and relevant materials submitted by participants in each conference. A number of partners were assisted in the construction of their own web pages through a training workshop for information specialists. Specialized thematic discussions groups led by technical moderators are ongoing in the areas of remote sensing, integrated pest management, and gender and NRM. InfoAndina is rapidly developing as a core activity of CONDESAN providing the means for multi-directional communication between partners and specialists in many different NRM and rural development related topics.

e) Policy Interventions in the High Andes (50215)

The project was built on the results of an earlier initiative, Integrated Policies for Rural Development (93-8756), and was developed within the context of CONDESAN as an IDRC contribution to the Consortium's policy component.

The focus of the project arose from observations that the roles of development actors are often ignored, or given less attention, than technical aspects and that consensus building often takes place among intermediary organizations rather than at the grass roots organization level. Actors in decision-making hold diverse needs, objectives and agendas and reaching some consensus on integrated policy options is a difficult and often futile process. The project defined policy intervention as actions taken by different stakeholders in the context of a participatory approach to assess needs and opportunities for improving resource management and income levels. Focus was placed on a particular experience in Cajamarca province in Northern Peru where an experimental "*concertación*" or round table process (CTC) was underway for the drafting and management of development policies and a medium to long term provincial development plan. The CTC included representatives from municipal and provincial governments, government agencies, and development NGOs. Six thematic "round tables" were constituted dealing with:

- natural resources and agricultural production;
- urban environment;
- women, family and population;
- production and employment;
- education and culture; and,
- cultural heritage and tourism.

At the start of the project, the CTC experience encompassed 98 institutions and provided a unique opportunity to study and test various approaches to multi stakeholder consensus decision-making strategies.

This work is still going on within the CONDESAN context and round table processes have been introduced in other benchmark sites, particularly in Ecuador. The May, 1999, Infoandina electronic conference on Local Government and Agricultural Development in the Andes was motivated by this work as well as by the delegation of more responsibilities to local governments, and by a broad interest in learning from and sharing existing experiences. It is a long term endeavor and identification of impact at this point is premature. Nevertheless, the experience thus far, with all its difficulties and weaknesses, is generating interest and shows potential for promoting viable development policies and achieving the consensus necessary for their productive implementation.

4.2.6. South American Camelids (Peru) (80-0109, 85-0253, 89-0040)

The research focus of this series of projects was on High Andean natural grasslands and their utilization by native camelids, principally alpacas (*Lama pacos*). Better management of the natural range lands and the improvement of alpaca production systems are of relevance to some 200 000 rural families who make their living from raising these animals. Camelid fiber is valued in the textile industry, its meat is one of few animal protein sources for mountain inhabitants and its skin is used for clothing and handicrafts. The project was complementary to the IDRC funded Pasture Management (Peru) projects (see section 4.2.1) which also deal with high altitude pasture development. This project, however, deals with pastures over 4 000 meters above sea level.

The recipient organization, IVITA, is a specialized veterinary medicine research and development institute at the Universidad Nacional Mayor de San Marcos, in Lima, and is one of the very few institutions with expertise on camelids. The knowledge base on all aspects of these animals was very narrow so much of the work was, in a very real sense, pioneering. This situation is probably reflected in the very slow start in the project, in addition to initial lack of leadership and research focus, staff losses, and partial destruction of the La Raya field research station by terrorists. These problems were eventually overcome by IVITA appointment of a capable and motivated project leader at La Raya, organization of research design workshops with input from IDRC staff and consultants, participation in related research networks and periodical consultant support arranged by IDRC. As a result of this IDRC initiated support effort, the project shifted emphasis from isolated technology interests to a more client-oriented, on-farm research focus. Good progress with respect to initial objectives was observed by the end of the

initial five year phase (PCR 80-0109, 09/16/87). Of particular note are the capacity building activities which included student thesis studies, researcher participation in RISPAL animal production network meetings and an IDRC organized workshop on which 30 IVITA researchers received their first exposure to animal production system research methods and concepts.

A second phase followed on the achievements of phase I seeking better technologies in pasture production and utilization, herd management, animal health and breeding advances and improved alpaca production overall. Links were established with INIA to organize farmer field days and train extension workers in two workshops. Contacts with a national marketing enterprise for market studies were also established to determine appropriate marketing channels, improved pricing, and introduction of fiber quality standards. The project continued to participate in the RISPAL network. Project outputs included a variety of technical alternatives tested and the most promising integrated into recommendations for improving alpaca production systems.

Reflecting the long-term nature of this kind of research initiative, support for the alpaca work of IVITA was extended into a third phase in 1989. The objectives and activities continued in a similar fashion to those of the two earlier phases. Several long term on-farm studies were completed and results packaged in operational recommendation packages for dissemination. All aspects of alpaca production were covered from pasture management and animal husbandry and health to animal selection for fibre production, color and quality. Towards the end, an agreement was signed between IVITA and the Microregion Development Corporation to transfer and finance technology recommendations to peasant communities. More information on the impact of the IVITA work and IDRC support is presented in a case study in section 6.

4.2.6.a. South American Camelids Information Service (82-0165)

The Information Sciences division of the Centre developed this project in support of the AFNS division projects with IVITA. Appropriate organizations with the capability to develop and maintain information services of the type envisioned were scarce but eventually two organization with some record of work with camelids were selected: IVITA in Peru and INFOL in Bolivia. The latter was a government institute created in 1977 to undertake research on production, marketing and industrialization of camelid products and by-products. INFOL had a specific mandate to create, adapt, improve and disseminate scientific and technological information in these areas. One specialist at the center had already compiled a bibliography on camelids with 2000 citations. At IVITA, a Committee for Library Operations was formed in 1981 to coordinate information activities throughout the IVITA central and field-station libraries and reading rooms. INFOL first requested IDRC support in 1978, and again in 1980, but to IDRC staff, IVITA seemed to represent a more research oriented and suitable collaborator. IDRC organized a meeting between the two organizations in 1982 to promote coordination of their information activities and to draft a proposal for the establishment of an information service on South American camelids.

A comprehensive list of activities was agreed to including, among other things: construction of a thesaurus; consolidation of lists of holdings and their coding; monthly exchange of abstracts and their quarterly publication; independent photocopying services; identification of topics for monographs; publishing of a quarterly technical newsletter; preparation of a directory of organizations, researchers and specialists in the subject matter from the five countries; publication of reprints from each of the collaborating organizations each year; and, organization of yearly technical meetings between INFOL and IVITA.

Unfortunately, the achievements of both institutions fell short of the anticipated objectives (PCR 82-0165, 08/09/89). Little contact between the two organizations was initiated without IDRC intervention. It was not until a documentation specialist was provided on a five month consultancy at IVITA in early 1986 that the activities took on a professional orientation and basic equipment such as a photocopier, electric typewriter, and shelving were purchased. Contacts were established with client institutions in Peruvian towns and a seminar held on the production, analysis and use of scientific information attended by 34 members of 15 organizations. At project termination, approximately 3500 documents had been identified for inclusion in the bibliography. INFOL too was slow initiating expected activities, a thesaurus prepared was judged to be quite general and there was no evidence of consultation between IVITA and INFOL to share modifications and observations. INFOL staff received no training but they did organize the first National Convention on South American Camelids and two round tables on Camelid and Ovine Information and Documentation. Both organizations recorded production of various technical publications and dissemination materials.

Various personnel and organizational difficulties were experience in contracting and initiating the project. The principal specialist who was the driving force behind development of the project resigned before the project got started and key management personnel did not understand the importance or content of the proposed activities. A vacuum in IDRC project management left by the untimely death of the IDRC program representative in the region also contributed to the initial delays. In the end, however, IVITA managed to establish a reasonable information service with the beginnings of a national network but the anticipated linkages to other IDRC supported work and collaboration with INFOL did not materialize.

4.2.7. Small Animals Production Systems (Peru) (85-0182, 89-0115, 93-0028)

Household food security is a very important concern for the impoverished Andean populations living in both rural and periurban communities. A partial solution to the problem is the development and promotion of technologies for family enterprises and a common alternative is the raising of small animals to produce high quality protein and other high value products. Guinea pigs are native to the Andes and have been part of traditional Andean food systems for centuries. They feed on kitchen residues, weeds and other available forage materials, are easy to control, breed prolifically, grow quickly and occupy little space. Raised principally by women and children, traditionally in the kitchen, they provide income and animal protein. There are problems associated with this practice, however, in the form of contamination of surroundings and infestation by

internal and external parasites which can be transmitted to humans. While this set of projects was based at INIA facilities at La Molina, Lima, the results of the research were introduced in the various IDRC supported Andean production systems projects in the mountains.

The first project in this series, *Guinea Pig Production Systems (Peru) I (85-0182)*, was started in 1986 building on earlier experience in breeding, nutrition, and management of this species under intensive commercial rearing systems at INIA. Breeding stock had been exported to other Andean countries, especially Ecuador, Bolivia and Colombia. Only limited attention had been paid to improving production under household and family enterprise conditions. The aim of this project was therefor to develop improved guinea pig production systems appropriate for household and family-based small enterprises. The project was a member of the RISPAL Network with links to fifteen other production systems projects. Promising results were achieved in the first four years and continued support was granted to further develop the best alternatives in the project *Guinea Pig Production Systems (Peru) II (89-0115)***.**

Results of the project were judged to be very good, and uptake of the output was strongly promoted by the project in periurban zones around Lima and in the Cajamarca region in northern Peru. Improved animals were introduced in southern Peru within the PISA project context, however, the extent of the impact of this work is not clear. One study did show that under *altiplano* conditions, kitchen-based production was best because of the normally low ambient temperatures which reduce guinea pig metabolic efficiency and increase feed consumption. While larger scale production in special pens did not take off in Puno, improved breeding stock was distributed quite widely in the region (Tapia 1999). The project achieved important successes in biological research but social impact results were not adequately evaluated. However, initial assessment of participating families in the project indicated improved living standards and higher income from sale of surplus animals. Direct participation of women farmers in the projects demonstrated the potential for raising guinea pigs under better hygienic conditions and with better managed feeding, reproduction and selection practices. The improved systems provided significant productivity and income increments and drew interest from development projects looking for income and employment opportunities for women and youth in ways that could also address food security issues.

Project staff were very active in dissemination activities and in working with students. Through national training courses, 163 professionals, 51 farm technicians, 20 social promoters, and 81 extension agents received instruction on improved care and management of guinea pigs. Fifteen in-service training sessions were organized. In collaboration with FAO, three international training courses were given and technical assistance was provided to similar projects in other Andean countries. A compendium of guinea pig research results in Peru and other Andean countries was compiled and team members presented 20 research papers at national meetings and 10 papers were given in international meetings.

Despite the above successes, interactions between components of the household production systems were still insufficiently understood. In what is essentially a third

phase of the guinea pig project, Household Small Animal Production Systems (Peru) (93-0028) which included some additional small species was developed. Further adaptation of the improved production methods for management by women and children was achieved and a fuller understanding or the interactions among the different production activities in which they are involved. The project continued to train extension workers, women, children and community leaders in better husbandry methods and to exchange information with projects and development organizations which apply the recommendations in their development initiatives. More detail is provided in the Guinea Pig case study in section 5.

4.2.8. Economics and Methodology Projects

To give an idea of the scope of research related to rural and natural resource based production issues undertaken with IDRC support in the region, a sampling of other projects related bear mentioning. Sometimes the work was in the same organizations as the IDRC funded agriculture technology led research but without evident contact or collaboration. IDRC urging was often not enough to generate exchange of information and communication due to the sharp divisions and even competition for recognition and resources between disciplines and departments.

4.2.8.a. Agroeconomics in Farming Systems (Peru) (85-0122)

The recipient of this project was INIPA (later called INIA), the same organization within which the PISA project was simultaneously being initiated. Oriented principally toward methodology development, the project was undertaken in the Lima-based Agricultural Economics program of INIPA and integrated with on-farm activities of the agronomy group in the regional office CIPA XIV in Cusco. The work was focused on developing an operational methodology for conducting farming systems research, on-farm, for the generation of appropriate technology for the small farmer.

The project produced four procedural manuals on:
i) establishment of homogeneous production zones;
ii) identification of problems and limitations to current production;
iii) identification of available technology to meet biological problems; and,
iv) technical and economic evaluation of on-farm research trials.

Peruvian researchers had the opportunity to work with and adapt FSR methodology in the characterization of Andean farming systems. Appropriate technology alternatives were identified to address specific problems of 4500 small farms. There was no mention of contact with other related IDRC supported research in the same organization or nearby field research sites. Application of research methodology and analysis in some cases was weak or flawed, a not uncommon occurrence where too much is expected from relatively unsophisticated researchers (PCR 02/19/86).

4.2.8.b. Dynamic Analysis of Farm Data (Peru) (87-0182)

During a Farming Systems Research workshop in 1986, note was taken of the lack of adequate procedures for dynamic analysis of farm data. This was also a need identified by researchers in the RISPAL animal production systems network. In response, a project was developed by the Centro de Estudios y de Desarrollo Agrario del Peru (CEDAP) to generate and test procedures for design, collection, and analysis of small farm records in such a way that applied research projects could make efficient use of such information. Activities involved the testing of various analytical methods to better utilize the large amounts of data being collected in field research projects and included determination of those variables which are most meaningful to the technology development process and its further evaluation.

The project produced the expected technical results although one of the more sophisticated multi-variable analyses was eliminated from the assessment after it was found to be too difficult to manage and well beyond the technical ability and facilities available to most research teams who were expected to benefit. The most useful output was a set of farm activities flow charts based on electronic spread-sheets which organized farm records of activities and resource flows temporally. This allowed clearer interpretation of farm activity patterns such as: seasonality; major trends in inputs and outputs; and, how flows of physical factors and money move over the year.

While the tables were useful in comprehending the farm system and interactions among production sub-systems, they were not that helpful or easy to use in understanding the longer term, multi year dynamics of interest. The methodology and construction of the flow charts were published. A series of papers, based on the work, was compiled and published in book form by the Peruvian Science and Technology Institute. The farm activities flow charts are reported to have been used by a number of participating projects in the RIMISP and RISPAL networks. As a result of this work, substantial reduction has been possible, in some cases, in farm sample size and the number of variables recorded in dynamic data gathering for farm system characterization. Four additional projects tested the results in other countries with varying conditions in the context of the RIMISP network.

4.2.8.c. Decision-making Analysis (Peru) (90-0137)

This project was undertaken by CEDAP, the same organization which successfully carried out the above project on Dynamic Analysis of Farm Data. It was aimed at formulating a conceptual framework and constructing methodological procedures to understand small farmer decision-making processes. The results were to be integrated into the development of technology alternatives and strategies for technology transfer.

The research resulted in the first approximation of a comprehensive set of definitions and instruments contributing to understanding common processes that small farmers follow in making decisions related to resource allocations and farm management. Beneficiaries were researchers and organizations devoted to generating and disseminating improved technology packages to small and medium sized farmers. The results were intended to

enable R&D teams to substantially improve their research and implementation capacity and effectiveness.

4.2.8.d. Rural Credit (Peru) (86-0296)

This Social Science Division project involved a study of six communities in two Andean micro-regions in the provinces of Huancavelica and Puno. The research set out to assess the needs of peasant communities and develop new ways of providing rural credit by government agencies. Work was carried out in association with the Agrarian Bank of Peru which had a mandate to provide integrated inputs, technical assistance and credit packages to farmers. The actual and potential role of credit in household and community production strategies was examined in order to obtain a more complete understanding of credit needs and to arrive at more realistic recommendations for integrated rural development projects. The main aim of the project was to bridge the gap between academic, mostly anthropological, studies and the operational information needs of decision-makers. No mention is made of connections with other IDRC supported rural and agricultural development oriented work in the region.

4.2.8.e. Community Organizations (Peru) (87-0162)

This project was supported by the Social Science division at a research institute associated with the regional university in Cusco, Peru, and came after the PISCA project was completed. Comparative studies of management organization commonly found after the agrarian reform were conducted in Agricultural Production Cooperatives (SAIS) and Peasant Communities. The study was intended to contribute to the design and implementation of more effective rural development policies by proposing models for the organization and management of production by social groups. In carrying out the study, researchers combined traditional survey methodology with a structural analysis of social network relationships through which resource allocation and production decisions were taken in the communities.

Findings and experiences were presented at two conferences on Andean communities, one of them international involving various Andean country research organizations. The results were applied directly in a regional development project. Not all of the objectives were successfully pursued and a comment in the PCR points out a common problem with many project proposals from ambitious but relatively inexperienced research teams. Objectives were too numerous and given limitations of time and resources, unrealistic. This could be a general comment on IDRC project selection and management which might be more selective and provide more assistance in concentrating research effort on fewer and more strategic objectives.

5. Case Studies: research activities and outputs

5.1. Germplasm related activities

Important changes have been observed in the areas of Andean germplasm related research, production and conservation since 1970. These initiatives continue and today are strongly linked to concerns for maintaining biodiversity. While IDRC support did not focus directly on germplasm collection and maintenance, it did contribute substantially to these activities as a natural component or adjunct of its overall productivity enhancement oriented projects. The following commentary relates the history of this work in Peru and IDRC's contribution.

In 1970 there were no collections of Andean crop germplasm available in Peru with the exception of a small quinoa collection in Puno composed of between 120 and 130 accessions in the Ministry of Agriculture. In Bolivia an unknown number of accessions was located at the experimental station of Patacamaya.

Germplasm related activities in Peru were originally centralised at INIA, an important partner in the projects supported by IDRC. Before IDRC came on the scene, INIA had been involved in isolated collection work centred around not more than five Andean species, among them quinoa, and a number of tropical species. A recent publication on this subject (Consorcio para el Desarrollo Sostenible de la Ecorregión Andina 1998) points out the pioneering role that IDRC played in focusing attention on the conservation of Peruvian genetic resources. These activities are continued in projects presently underway at CIP and through CONDESAN.

Serious collection of Andean plant genetic resources was initiated in 1973 by the High Andes Program of IICA supported by IBPGR and by 1979, more than 10 collection expeditions had been financed and mounted in southern Peru and in Bolivia. With these activities, collections of quinoa, kañihua, tarwi and Andean tubers were established or expanded and deposited in premises modified or built at the following sites:

Bolivia

- Belén Experimental Station: storage warehouse repair;
- Patacamaya Experimental Station: collection improvement and organization;

Peru

- Camacani Station, Universidad Nacional del Altiplano, in Puno: construct and equip germplasm bank including warehouse, storage facilities and office space;
- Kcayra experimental farm, Universidad Nacional San Antonio Abad in Cusco: construct and equip germplasm bank facilities with warehouse, storage and office space;
- Allpachaca Station, Ayacucho: construct and equip underground storage for roots and tubers;

Ecuador

- In Riobamba, collection expeditions and construction of a storage facility were planned with the local University but these activities were not expedited for administrative reasons in the IICA.

IDRC influence was first provided through the PISCA project fundamentally by strengthening the universities' participation in the gathering, characterisation and *ex situ* conservation of germplasm of the main Andean crops. The same influence and support was continued in the PISA project between 1985 and 1990.

After 1986, concepts went beyond simple collections of germplasm to encompass a system of agricultural bio-diversity conservation in the Peruvian Andes which was created principally with the participation of the following organisations:

- INIA in Cajamarca, Huancayo, and Ayacucho;
- The Cusco, Puno and Ayacucho Universities through the PISCA project regional co-ordinators, and subsequently, with the Cajamarca National University professors participating.

The PISCA project was the beginning of institutional relations among the university professors of southern Peru (study trips, seminars, courses, workshops), which paved the way for a strong collaboration in the gathering and conservation of genetic material from Andean crops. One concrete example of this co-ordination is the March 1980 course on quinoa genetics held in Puno and financed by IDRC. These new relationships between the universities provided opportunities for them to define shared priorities for plant genetic resources research and division of responsibilities was agreed upon for the collection and conservation of germplasm material as follows:

- Cusco University to look after potatoes, tarwi and kiwicha;
- Puno University to specialize in quinoa, kañihua and bitter potato;
- Ayacucho University to take responsibility for Andean tubers such as oca, olluco, mashua as well as tuna.

This allocation of responsibilities did not include forages or animal genetic resources in which other organizations such as La Molina University in Lima, INIA and IVITA were more deeply involved. All of these were receiving IDRC support as well.

This agreement on a co-ordinated approach among the professionals responsible for the germplasm banks (mainly the co-ordinating professors for PISCA), was based on their awareness of the range of materials adapted to the variation in mountain environments. For example, in quinoa it was important to differentiate between the *altiplano* varieties for Puno, and the valley types being grown in Cusco and Ayacucho in inter-Andean valleys with mesothermic conditions (Tapia 1990). Based on a systematic evaluation of materials in the germplasm collections, an improvement program of the valley quinoas was initiated resulting in the selection of improved varieties for valley conditions.

In the same manner, professors of the University in Cusco, with IDRC support, prepared and published a review of research carried out on Andean tuber germplasm. Thanks also to IDRC support, descriptors (in IBPGR format) and catalogues of tarwi and kiwicha were prepared and published and field collection expeditions were carried out.

Construction of storage buildings for the Andean crops at the regional universities and, trips to collect a wider range of genetic materials (financed through IBPGR) made it possible to greatly augment and organise the *ex situ* conservation of the long ignored Andean species. It also allowed professors at the universities to involve students from the region in the evaluation of the collected materials through their thesis studies, many supported from IDRC project funding. These studies contributed to the selection of new varieties adapted to specific ecological conditions (new varieties of quinoa, Tahuaco group for example) which are presently planted by farmers in relevant Andean environments. Quinoa material gathered during an IDRC supported collection trip in southern Colombia, once evaluated, made possible the creation of the Nariño variety of quinoa (1983). This variety contains very little bitter saponins and is very suitable for the inter-Andean valley environments. Work was also conducted on lines of kiwicha acquired from Tarija, Bolivia, that formed the basis for the Oscar Blanco and Noel Vietmayer varieties, widely grown today.

An evaluation carried out towards the end of 1986 demonstrated the advances achieved over the prior 15 year period during the latter part of which IDRC was an important facilitating partner. Table 2 shows the number of accessions of Andean plant materials held in various Peruvian germplasm banks in 1986. Substantial progress is evident when comparing these numbers with the 130 accessions of the Ministry of Agriculture in 1970. IDRC contributions are readily acknowledged by the many Andean researchers who took part in the multiple facets of this work.

Table 2: Peru: Number of accessions in Andean germplasm banks, 1986

Crops	Puno	Cusco	Huancayo	Ayacucho	Cajamarca	Total
Quinoa	1 500	198	48	425	430	2 601
Kañiwa	330	---	14	47	---	391
Kiwicha	---	570	32	109	17	728
Bitter Potato	68	130	42	257	---	497
Oca	120	610	168	122	30	1 050
Olluco	40	18	118	61	18	255
Mashua	65	14	47	107	---	233
Tarwi	228	1 200	1 300	325	126	3 179
Total	2 351	2 740	1 769	1 453	621	8 934

Source: (Tapia 1999)

5.2. Andean Camelids (alpacas)

Of all the IDRC supported projects analysed, the program on camelids is perhaps the one exhibiting the greatest continuity. This is undoubtedly due to the fact that the projects in this program were organised around a more narrowly defined subject and animal research inherently tends to be long term. This observation, however, should not detract from the fact that these projects took on a production system perspective which went well beyond traditional discipline defined approaches to animal production research. The narrower focus derived from the situation in which Alpacas are raised. Normally, this entails less interaction with other production activities than is encountered in crop production systems. Nevertheless, management decisions required of producers are still complex.

The beneficiary of the first projects was the Veterinary Institute for Tropical and Highlands Research (IVITA) under the Faculty of Veterinary Medicine of the San Marcos National University. After twenty years of IDRC support, IVITA continues to undertake research and development activities on camelid production related problems and incorporates these into a production systems perspective.

According to IVITA executives interviewed for this study, the systems methodology promoted by IDRC in the projects it supported is used today by all the researches associated with the institute. The production systems focus is also used in teaching and is included in the curriculum of the Faculty of Veterinary Medicine. One of the informants has been involved with the IDRC supported work from the beginning and is now the director of the Marangani field station, one of two locations where IVITA carries out highland research. It succeeds the La Raya (Cusco) experimental station, which was destroyed twice by the activities of Shining Path during the internal conflict in Peru.

Continuity is also reflected in the relationship between research and production activities in the communities. One of the main objectives of the projects was to promote analysis of technological alternatives through field research. This was achieved through the activities of the technicians at IVITA's experimental stations, particularly those from La Raya (Cusco) who settled in the nearby communities of Ñuñoa and Mascusana (Puno). There they managed to establish experiments with nearly two hundred alpaca producers dealing with problems of animal reproduction and population management, introduction of new systems for animal pairing, management and improvement of grasslands, the introduction of pasture legumes to improve forages and other activities.

The IDRC supported projects encouraged IVITA researchers to test their knowledge gained from years of experimental station work under true operational conditions. Until then, their research results had never been evaluated against real life producer constraints and production requirements within the context of the integrated management approaches practised by the peasants. At least two of the former technicians, today veterinarians, continue to work under contract to the same communities providing technical assistance on management and animal health issues. The informants pointed out that because of these long term relationships, they encounter strong interest on the part of the producers to collaborate with IVITA, rather than with the regional universities. They attribute this to

their supportive long term experience with the producers and their problem oriented technical capability.

It was not possible to verify this opinion of the IVITA executives through a field visit but several differences with the Universities might be presumed. IVITA has a much more defined area of responsibility which corresponds with a real and perceived need of the producers. The technology and management solutions they provide has the potential to result in greater income increments than that provided by the universities which cover many aspects of production systems. IVITA is charged with both research and development actions as their main purpose while the universities are more research and teaching oriented even where they have engaged in on-farm and community activities. And finally, IVITA work was in the context of co-operative farms with greater capitalization and the ability to hire technical expertise. The regional universities supported by IDRC in other projects worked more with small farmers in traditional communities where these advantages were not available. In the final analysis, however, the factor of continuity and long term IVITA participation with community members is likely the most determining factor. It takes time to establish credibility and to become intimately familiar with the specific range of problems faced by rural producers in difficult environmental conditions.

According to the IVITA researchers, it required ten years to understand the alpaca's specific biology of reproduction (Sato Sato and Montoya Ortega 1990), which differs from that of sheep to which they had long been compared and from which management practices were ineffectively extrapolated. This testing is continued today and results are evident in many published research works, university theses and in educational and extension type manuals and brochures. IVITA's scope of influence has gone much beyond that of San Marcos University itself. This influence can be seen in the University at Cusco where local student involvement in experiments in the communities resulted in two Cusco University theses[3]. One of them (Agramonte Villa 1987) is on measuring the length of the alpaca fibres in production systems, communities and small alpaca producers. The other evaluates the growth rhythm of alpaca fibre. At San Marcos itself, three theses were developed based on field research in the collaborating communities. One of them (Ortiz Rojas 1988) is an evaluation of mortality control methods in young alpacas. Another (Braga Loza 1987), deals with the effects of altitude in the production of alpaca fibre and a third one, on which only verbal reference is available, is about determining the lactation curve of alpacas and llamas under natural pasture feeding conditions.

About fourteen research papers have been published in IVITA's Livestock Research Magazine, which was preceded by the IDRC supported South American Camelids Magazine. These research papers were based on studies carried out at La Raya experimental station and corroborated in local communities. Numerous scientific articles, written by IVITA personnel involved in IDRC supported projects, have been published in *Turrialba: the Inter-American Agricultural Science Magazine* put out by IICA. Without claiming it to be representative of all editions of this magazine, in one of the 1991

[3] Only those theses are cited where specific mention is made of IDRC support.

editions, six of the fifteen articles published were related to IDRC supported projects. Two of them (Agramonte and Leyva 1991) (Leyva and Markas 1991) were related directly to IVITA projects.

Continuity is also demonstrated in the fact that through the IDRC sponsored projects, collaboration with government organisations and NGOs was established and frequent contacts still continue. Through IVITA, other projects with related technological diffusion components have received technical support. Two such projects in INIA are PISA in Apopata (Puno), sponsored by CIDA and IDRC and the Swiss supported PAL project, both carried out by INIA. It is worth mentioning that contacts with the Swiss development agency have deepened and that COSUDE and the Peru-Swiss Exchange Fund are now the main international financing sources of IVITA.

IVITA has assisted in the creation and development of a co-ordinating body for the alpaca production sector called the Institutional Co-ordinator for the Alpaca Production Sector (CISA) that links all the different actors associated with this sector. Through this body, and also directly, IVITA facilitates actions with NGOs that provide technical assistance to producers. Communication links are thus established with the NGOs on the basis of producers needs as perceived by IVITA from their own field experience and from the requests received. IVITA also actively participates in livestock fairs taking place in the region. These have developed considerably in the areas influenced by IDRC sponsored projects.

The project leaders admit that one thing lacking in the camelid projects has been an evaluation of the social changes and impact in the communities going beyond the experimental results and the transfer of technology. On the other hand, the production systems focus as well as the integrated diagnostic studies carried out in the context of the IDRC sponsored projects, facilitated new orientations in collaborating universities and the communities. However, in the informants' judgement, some elements of that influence have been lost over time, especially in the case of the universities.

5.3. Guinea Pigs

An IDRC sponsored project which favoured a completely Andean species involved research and production of guinea pigs. This project began in 1987 and continued until 1997 in three stages. It provided continuity to INIA experience accumulated since the 1970s at its La Molina research station. The INIA budget for guinea pig research was always minimal and IDRC support meant a very big contribution "to re-establish to a reasonable level the research on guinea pigs and to facilitate dissemination of the results" (Pomareda 1999). After 1994 additional activities were included in the project involving other domestically raised species however, the focus continued on guinea pigs.

At its inception, this project was directed by Marco Saldivar who was assassinated by Shining Path terrorists in 1991. Later, his widow Lilia Chauca, took charge of the project and ensured its continuity to this day. The guinea pig project is currently supported by the Swiss agency COSUDE.

The raising and consumption of guinea pigs has been practised in Peru since pre-Inca times. Before the arrival of the Spanish, it was the most popular meat consumed by the population of the Inca empire which extended to include most of the Andes in what is today known as Colombia, Ecuador Peru, Bolivia and Chile (Pomareda 1999).

"The guinea pig is a small rodent. Depending on the breed, its weight (adult) varies between 700 and 2500 grammes, the indigenous types being the smallest. Traditionally it is raised in groups of 20 to 30 animals inside the houses (in the Sierra region) and in pens next to the houses (in the rest of the country). Somewhat larger family farms and commercial production establishments can also be found" (Pomareda 1999).

The guinea pig is very prolific. A simulation model used by the IDRC sponsored project (Perú. Instituto Nacional de Investigación Agraria 1998) started with five reproductive males and 30 females. After two years, the final gross inventory reached 924 animals and if 42 lost to mortality, a net population increase of 882 results. This would mean, according to the model, a very important source of food and household income from selling what exceeds family consumption needs. This type of activity is possible since production takes place in a relatively limited number of households.

There are no trustworthy estimation figures of the total guinea pig population, however, 25 million is often cited for Peru. Given the high birth rate index of the species, there are many references to an annual production of 60 million specimens, equivalent to approximately 20 000 metric tonnes of meat. In spite of the untrustworthiness of these references, an analysis of the 1994 livestock census results allowed Pomareda (Pomareda 1999) to formulate the following conclusions:

- The guinea pig population in urban and suburban households is probably around seven million;

- Fifty six percent of the population is found in households located in the five departments of the Sierra region which, in order of importance, are: Cajamarca, Ancash, Huanuco, Junin and Cusco;
- Due to migration from rural to urban areas, and especially the population influx from the Sierra toward Lima, the largest concentration of domesticated guinea pigs today is likely to be found in the capital;
- This phenomenon of urbanisation in guinea pig production and consumption has meant an improvement in productivity through use of better quality breeding stock and new management techniques, both more readily available in the urban setting;
- Approximately 73% of the guinea pig population is to be found in the households of land less peasants and periurban neighbourhoods or in small farming enterprises of less than 5 ha.

The importance of domestic raising of small animals as a source of family food and income has been pointed out on many occasions. Apart from being a family activity, it is one normally carried out by women since it is an activity compatible with other responsibilities of the woman in the home. It has been observed that raising guinea pigs helps raise a women's self-esteem as well as her position in family relationships and those in the neighbourhood because the activity allows her to generate an independent income stream which she can control.

The strategy of the IDRC sponsored project was built on three basic themes:

- Rigorous and systematic continuity of technological research with emphasis on genetic, nutritional and reproductive management aspects;
- Permanent complementarity and feedback between research, testing and transfer of results, with the participation of the producer, especially women;
- Locally based inter-institutional alliances and community led actions to spread the results among the population.

From this strategy the following client groups were identified:

- Producers linked directly to the project because of their active participation in various stages of testing and follow up;
- Producers indirectly linked by way of extension and training and/or breeding stock received through rotating funds;
- Producers influenced by other experiences and/or who had acquired animals bred through other projects or suppliers;
- Students exposed to training activity and brochures;
- Researchers and technicians taking part in training and/or work experience;
- Companies, organisations and institutions by agreement with INIA.

In general terms, the Pomareda evaluation (Pomareda 1999) draws the following conclusions related to the surroundings and institutional conditions.

> "Political and social conditions surrounding the project were not favourable, particularly because of terrorism. However, the economic crisis prompted many families to seek a strategy for subsistence in which guinea pig breeding played a very significant role.
>
> Regarding institutional aspects, relations within INIA were generally positive and reflected an appropriate environment for project development. However, because of an internal requirement for all activities within INIA to be financially self-sufficient, adequate resources for research were not available.
>
> Arrangements for co-operation with other institutions were positive and had a high multiplier effect.
>
> The project has become "the point of reference" on knowledge and availability of pure-bred breeding stock.
>
> The conclusions of this work are an endorsement to the unprecedented efforts in farming research in Peru. It is anticipated that these conclusions will be useful to the authorities to define a support program to research and to promote guinea pig production."

Feedback from many interviews carried out within the framework of the evaluation study, supports claims that the guinea pig projects have had an important impact in Peru on the following fronts:

- Genetics, by producing improved breeds, the stabilisation of genetic lines, the increase of prolificity and in increased body weight;
- Nutrition, by improved diets, development of post-weaning management, muscle development and fat content in the tissue, and techniques to utilise human food scraps in the household for feeding the guinea pigs;
- Sanitation, although research in this field has been more reduced than on other areas, interesting results have been obtained in eliminating mites and fleas, in the cleanliness of beds and in facility sanitary control;
- Reproduction management, by research on the number of litters, lactating periods and the number of births per female;
- Technology, by introducing new management techniques;
- Income, by a significant increase in income in the households participating in this experiment;
- General management, research results regarding construction materials used in the facilities, number of animals per water fountain, security and ventilation of the facilities.

Dissemination of this experience can be measured by the large number of request received by INIA for information materials and especially by purchase of improved breeding stock. Through this dissemination guinea pig production has reached other

urban and rural zones of Peru and has reached commercial scale projects in Ecuador, Bolivia, Colombia and Indonesia (Pomareda 1999).

Finally, it should be pointed out that the projects mentioned here were not the only ones that received IDRC support for guinea pig production. In fact, under PISA the biggest guinea pig breeding facility of the department was built in Puno. From there, the improved breeding stock was distributed throughout the department (Tapia 1999) This guinea pig breeding facility had only one dissemination action before it was discontinued because of elevated feed consumption costs in the cold altiplano environment, but the descendants of the La Molina and Huancayo breeding stock were spread to more than 400 small farmers in the region.

Under the PISA project, the work of Oscar Arroyo from INIAA was published (Arroyo 1986) on the research results in guinea pig breeding. This stimulated many institutions to promote guinea pig breeding.

5.4. *Waru waru* reconstruction

Over many generations, farmers in low lying areas of the *altiplano* near Lake Titicaca developed a number of techniques for constructing raised beds or *waru waru* on which to cultivate their crops. The purpose of these beds was to create areas above the water level when the lake flooded low areas during the rainy season. Water in the channels around the beds provided moisture during long unpredictable dry spells and acted as a temperature regulator against the frosts experienced during the growing season. These raised beds and ridges had been ignored and in ruin for generations despite the evidence that large areas had once been cultivated in this manner. For the most part, they had been reduced to low productivity pasture lands.

Systematic study of the *waru waru* and the extent of their distribution was begun in 1981 with the Raised Beds Archeological Project (PACE) supported by the Peru-Canada Fund and by the PISCA project (Palao Berastain 1992), 25. A young student, Ignacio Garaycochea in the UNA Faculty of Agronomy in Puno, took note of this work and, in 1982, asked PISCA project coordinator José Luis Lescano for support to do his thesis study on recuperation of this ancient technology. He was awarded a scholarship and in his thesis reported on soil management on the beds and the importance of raising the organic material content of the soils as material is removed from the channels around the beds to build up the beds. From 1983-1985, archeological photography research was also done as a PISCA activity at UNA to determine the extent of *waru waru* distribution and form..

Based on this experience, two hectares of *waru waru* were rehabilitated in the Illpa experimental station in 1985 and experiments with crop combinations and rotations begun (Tapia 1996), 141. The purpose focused on finding ways to increase crop land in Puno by recuperating and modifying the techniques applied by the ancestors of the current inhabitants beginning as early as 2000 years BC. In the experiments, greater attention was paid to technical support and quality seeds in the first year and less in subsequent years in order to simulate farmer management and validate concepts for improvement and promotion of the system (Palao Berastain 1992), 120. Although the studies were not conclusive, some data (Palao Berastain 1992), 120, indicated increased yields of potatoes in *waru waru* —two to three times greater than without *waru waru* in the same areas. Other studies (Palao Berastain 1992), 107-108, indicated increased yields of kañihua and quinoa even greater than with potatoes were feasible.

In late1985, a workshop was organized under the sponsorship of the INIPA National Andean Production Systems Program (PNSA), headed by Mario Tapia, with participation of representatives from COTESU, Swiss Development Cooperation , who were invited to discuss the potential for research and promotion of *waru waru* technology and to define a long term rehabilitation project. As a result of this workshop, the COTESU office in Peru expressed interest in funding the proposed plan with INIPA. When senior INIPA managers failed to show interest, a new entity was created by COTESU called Waru waru Integrated Management Project (PIWA) in co-ordination with the regional government of Puno and UNA.

The rehabilitation of the *waru waru* is due to the work of different institutions. PISA supported work with experimental ridges and beds in the Illpa station and with the farmers of the Anccaca community, Huatta zone, where the raised beds represented a technological alternative. Over 10 ha of ridges were put into production. The Peru-Canada Fund financed the "Rehabilitation and Use of the *waru waru* as Community Development Support in Puno" project from 1989 to 1991. It was carried out by the Audiovisual Communication Center for Public Education (CCAEP) and the Francophone NGO, Canadian Centre for International Studies and Cooperation (CECI). During these years there was a direct technical relationship with PISA and the management of PIWA and other similar projects dealing with *waru waru* rehabilitation

The work in the Illpa station and Huatta were followed by further experimentation by PISA researchers in 1986 and 1987 in the communities of Huatta, Atuncolla and Carata, under the direction of Ignacio Garaycochea, mentioned above as a student and participant in the PACE work in 1981-1983. To these activities were added other rehabilitation work in Huatta, Atuncolla and Paucarcolla under the direction of Mario Banegas. At the beginning of the PIWA project, in 1989, 286 ha had been recovered in 55 communities (Palao Berastain 1992) 112. Currently, more than 1200 ha have been reconstructed. Nevertheless, Tapia has noted (Tapia 1999) 18, that the quality of the reconstruction work has varied greatly. In some locations, the area recovered related more to fulfilling institutional goals and to the distribution of tools and food as incentives and work lacked the required quality control.

Apparently the methodology used in the rehabilitation of the ridges was not always the most appropriate (Tapia 1999). It was observed that in the rush to develop large areas, too much infertile soil from the channels was used to raise and broaden the beds. This slowed the process of fertile soil development and raised the cost of initial construction. A more appropriate course, Tapia suggested and PISA research showed, would be more gradual or phased construction permitting better soil formation from slow incorporation of organic matter into the soil from crops grown on the ridges. In addition to the greater soil fertility and reducing the initial investment in labour, the resulting more convex form of the beds could facilitate the use of oxen or even machinery.

In view of the foregoing, Tapia notes (Tapia 1999) that the IDRC supported R&D activities of both PISCA as well as PISA were essential to initiating the promotion of the rehabilitation of *waru waru* technology as an appropriate agroecological alternative for expanding production in the Altiplano. This is particularly relevant in low lying zones subject to flooding and frosts during the growing season.

5.5. Revolving seed funds

Another case worth mentioning from among the activities undertaken in projects with IDRC support, is that of the revolving seed funds. These funds were a strategy developed in the PISCA and PISA projects to address the need to have good quality seed on hand and also to be able to respond to requests from farmers for both seed and credit. The funds were applied mainly to help farmers with good quality potato seed and, to a lesser degree, to provide improved broad bean and barley seeds.

The initial idea was to have the communities themselves manage the revolving funds with credit being given in kind, that is, seed and in some cases fertiliser. A peasant committee was formed to manage the fund in a Cusco community and the PISCA project technicians participated in decision-making with respect to the committee and selection of farmers who would get credit. This approach didn't work as the local seed supplier provided poor quality seed and the community did not back the committee. The second year, improved seed was produced by the University farm at Cusco and the community committee selected the members who would get credit naming them jointly responsible for the credit. This arrangement worked much better and resulted in the creation of a community potato seed nursery with credit for the community to produce its own improved seed.

In order to expand the PISCA experience, funds were granted from the Dutch Co-operation project at Cusco (approximately 12 metric tonnes of potato seed), from the University program at Puno (6 metric tonnes), and at Ayacucho from seed produced by the University Allpachaca station (4 metric tonnes). At the latter location, potato production and family incomes were significantly boosted through this mechanism which facilitated the dissemination of the *San Cristóbal* variety developed at the station.

In the PISA project, by 1988 and 1989 when inflation and devaluation in Peru reached levels over one thousand per cent per year, the revolving seed funds provided the only way they were able to maintain the value of their production investment. Payment for credit was accepted in kind thus avoiding losses from depreciated currency with which farmers would not have been able to buy back seed later.

According to a key informant (Tapia 1999), an important aspect to be taken into account in development projects concerning local needs, is the scale of work in peasant communities. In the Pisca project, dedicated mainly to research and testing of production alternatives, funds for development activities were minimal. While there was a total of 800 peasant families in the communities where the Cusco component of the project worked, the revolving fund could supply no more than 80 families (approximately 50 kg potato seed per family). Thus the project created opportunities and expectations to which it could not respond.

In the case of Puno, with the PISA project after 1985, seed nurseries received special attention. The work was carried out by INIA through its regional branch CIPA-Puno. The funds were considered a means of technical training on improved production alternatives linked to the use of better seed, some inputs such as fertilizer and the application of pest

and disease control methods. The selected crops were potato and bitter potato, barley and quinoa. Four types of nurseries were set up (communal, monitored individual, non-monitored individual and a control group). In four years (1985-1989), more than 100 hectares of improved seed potatoes were planted in five communities (Proyecto de Investigación de Sistemas Agropecuarios Andinos (PISA) 1993). The production from this seed reached significantly increased levels but a wide range of responses were observed. Pay back of loans in kind (seed) was much better than loans in cash (for fertilizers) and farmer management practises greatly affected results. In general, the relatively better off farmers were better organized and able to take advantage of the programme (Tapia 1996), 131-133.

After PISA ended, INIA Puno went on to produce more improved seeds than was produced by all other agencies of the country together (Tapia 1999) In 1986-1987 the profits of this operation surpassed USD 80 000. However, those funds were not capitalised and were spent on regular operations thus weakening the initiative and with the continuous changes in INIA, this activity has been greatly reduced.

To this day, however, the seed material can be found in the communities that participated in the PISCA project. Approximately 160 families benefited directly from the project by having access to improved and healthy seeds (Tapia 1999). It must be recognised that the impact of the program has been greatly reduced since no other project continued these initiatives. This was especially critical in Ayacucho, where, because of social violence during the eighties, a great portion of the improved material has been lost.

On the other hand, rotating seed funds require a very efficient administration and, because of climatic risks, a very conservative policy. In the years of drought, the funds were greatly reduced and the credits could not be recovered. However, in the years of adequate rainfall for the crops, the recovery rate was excellent. The strategy learned from this experience would seem to include the following guidelines:

- Credit for seed should be granted for periods of at least five years;
- Credit should not be given in only one agroecological zone;
- Nurseries should be in protected environments, in simple greenhouses for example, as tested in experiments in Puno; and,
- Seed funds should be co-ordinated with a commercial system to ensure minimum reference prices.

6. Twenty Years Later: a view from collaborators

6.1. Initiating a systems understanding

As noted in the introduction, some twenty years after the initial IDRC support for a production systems approach through the Andean universities in Southern Peru and the public agricultural research and promotion agencies of Peru and Bolivia, it seemed useful to trace and analyze the footprints left by these projects in the Andean institutions and communities involved. In sections 4 and 5, experiences from a variety of projects have been summarized drawing on documentation in files and publications at IDRC and through communication with programme staff who were involved. The current section now shifts to a perspective garnered from the organizations and individuals involved in and leading some of those activities. The focus is on a smaller number of projects which specifically attempted to introduce and follow a production systems approach to their work with Andean communities. Included are the projects known as PISCA and PISA and the Quinoa projects in Bolivia including their linkages to many other activities and organizations.

The acceptance of a systems approach varied greatly but increased with time so that in the nineties, it can be said that its application "has responded to a national option instead of responding to the influence of bilateral or multilateral donor agencies" (Berdegué and Ramírez 1995, 29). Nevertheless, the various approaches to the study of Andean agro-ecosystems have met with differing acceptance in the faculties of agronomy and agricultural sciences of the region.

Since 1943, agricultural research and extension in the Peruvian s*ierra* has been practised in accordance with different approaches and under various organizational forms (Tapia 1996). In great part, the research of this early period was focused on individual crops from a discipline specific perspective. Organizationally, formats have alternated from centralized to decentralized models and from the integration of research and extension in the same institution to their separation as independent functions. The creation or reconstitution of the Andean universities in the seventies [4], however, gave new impulse to the function of research in the faculties of agronomy, agricultural sciences, animal husbandry or veterinary medicine, "paying particular attention to the resources of the region" (Tapia 1996).

Berdegué and Escobar (Berdegué and Ramírez 1995, 21) place the initial application of a systems approach to agricultural development in Latin America in the early seventies. The pioneer projects identified by these authors are the Puebla project in Mexico, carried out with the support of the Rockefeller Foundation; the support of the United States Agency for International Development (USAID) to the Instituto de Ciencia y Tecnología Agrícola (ICTA) in Guatemala; and the Cáqueza project in Colombia, carried out with

[4] In some cases, these were new universities, like the Universidad Nacional Técnica del Altiplano, in Puno, founded in 1961. In the case of the Universidad Nacional San Cristóbal de Huamanga in Ayacucho, the university, founded in 1677, was reopened in 1959 after being inactive since 1821.

the support of IDRC (Zandstra, Swanberg et al. 1976; Zandstra, Swanberg et al. 1979). Other influential experiences are mentioned above in section 2.1.

During the Eighties, largely through IDRC support and influence, "systems" approaches and concepts began appearing in the region's research centers as a better way of comprehending and approximating production systems practiced among the peasant communities of the region (Tapia 1996), 96-97. As a consequence, the universities in Southern Peru developed educational, research and promotion work carried out by interdisciplinary and inter-institutional teams located in pilot communities selected to represent a variety of real situations faced by farming communities. That the communities were considered "pilot areas" had to do with their experimental nature developed outside the traditional laboratory or experimental station structure. They were carried out "through a continuous communication between the producer, extension worker and researcher (as a method) which would permit presenting the farmers with a proposal of *technology adapted to their conditions* [5], based on a clear understanding of the actual functioning of their productive unit and the regional and national needs, oriented towards intensification." (Tapia 1996).

The introduction of the systems approach was not without difficulties even among those that proposed its adoption and diffusion. As an example, in the PISA project (1985-1990), a marked separation between crops related activities and those dealing with livestock production was encountered in the first years of the project by the external evaluators in 1989 who commented as follows: "In experimental work to date, PISA has concentrated almost wholly on crop production. The Project has attempted some livestock research activities, but most have been short-lived. A small amount of forage work is being conducted in the communities, and PISA views this as the livestock program" (Thomas, Babcock et al. 1989). As explained in section 4.2.4, this discrepancy had to do with rigidities in INIA funding mechanisms and a lack of agreement and clarity on the focus and priorities of the PISA project research agenda beetween IDRC and CIDA.

In the case of Bolivia, efforts from the late seventies aimed at gathering experience centered on two areas of production: quinoa and alpacas. It would be more than ten years later before one could speak of attempts to develop an integrated production systems project and approach.

6.2. The institutions linked to the projects

Beginning in the late seventies and into the eighties, IDRC funded research work, with some form or approximation of a production systems approach, had been initiated and was operational in the following institutions:

[5] The italics are Tapia's.

In Peru:

- The Universidad Nacional San Antonio Abad (UNSAAC), in Cusco, through the Andean Crops Research Center (CICA) established in 1972 and directed by Professor Óscar Blanco;
- The Universidad Nacional del Altiplano (UNA) in Puno (previously Universidad Técnica), with the Post Graduate School (EPG) directed by Professor José Luis Lescano;
- The Universidad Nacional San Cristóbal de Huamanga (UNSCH) in Ayacucho. The Andean Crops Research Program (PICA) was established in 1974 and is directed by Professor Julio Valladolid;
- The Universidad Nacional San Agustín de Arequipa (UNSA) (as a substitute for Ayacucho when it became impossible to work in that region), project under the direction of Professor Guillermo Zvietcovich;
- The Instituto Nacional de Investigación y Promoción Agraria (INIPA), subsequently the Instituto Nacional de Investigación Agraria y Agroindustrial (INIAA) and now Instituto Nacional de Investigación Agraria (INIA) where Dr. Mario Tapia was the director of the National Andean Crops Program (PNSA) from 1985 to 1989 within which was situated the CIDA/IDRC supported PISA project.
- Within INIA the Guinea Pig production Systems project deserves special mention. It was followed by the Household Small Animals Production Systems project.

In Bolivia, one organization, The Instituto Boliviano de Tecnología Agropecuaria (IBTA), established by the Bolivian Government in 1975, was the main project recipient. IBTA is currently decentralized at the department level [6] and is being replaced by a new structure called the Sistema Boliviano de Tecnología Agropecuaria (SIBTA).

Project links with farming communities in Bolivia were characterized by traditional agricultural extension work focused on quinoa. Later on, greater articulation was developed between extension and other agencies, especially NGOs, and applied research related to cropping systems was introduced thus expanding beyond the original focus on quinoa.

6.3. Work in the Communities

Before the start of PISCA in Peru, anthropology and ethnology studies in rural areas of the Andes had already been carried out by some of the individuals who later worked with the project through the organizations listed above. In the diagnostic stages of PISCA, this earlier work was continued by multidisciplinary teams using similar approaches to identify a number of agricultural communities representative of the Andean conditions where the researchers could study farming practices and community related activities.

[6] In Peru as well as in Bolivia, the level of "department" corresponds to the territorial units into which both countries are divided. The next lower unit is the "province" followed by the "districts" which correspond to a municipal territory. In Bolivia, the rural districts equivalent are the so-called "cantones".Bolivia also has an intermediate division between the provinces and the districts or cantons, the so-called provincial section, but this unit is of little significance.

These studies were the basis for the experimental work in the chosen representative communities and their participation as "pilot communities".Two of these diagnostic experiences are mentioned as examples.

The first study is a compilation and interpretation of work, reported in the "Diagnostic of Eight Andean Communities of Peru in Cusco, Puno and Ayacucho" (Kervyn, Tapia et al. 1983), carried out by the principal researchers of the projects. The emphasis of this study was on the use of productive resources in the communities starting with their farming and livestock production systems. The ecological conditions, spatial and temporal arrangement of the crops, crop associations and techniques, yields, distribution of the land and property types, as well as the various forms of exchange. The characteristics of livestock farming and the integration of agriculture and livestock were analyzed and, finally, the use of the labor force is studied. The farming communities that were the subject of this diagnostic and the investigation of the land under the PISCA[7] project are listed in Table 1.

Table 3: PISCA Project Communities
representative of agroecological zones in Southern Peru

Departament **Community**	***Subregion*** **Agroecological zone**	**Altitude (m.a.s.l.)**	**Principal production**
Ayacucho	*Central South*		
Qasanqay	Suni/Puna	3500 – 4200	Livestock, agriculture
Arizona	Quechua/Suni/Puna	3300 – 4000	Agriculture, livestock
Cusco	*Central South*		
Cuyo Grande	Quechua/Suni/Puna	3500 – 4300	Agriculture, livestock
Sacaca	Quechua/Suni/Puna	3500 – 4 00	Agriculture, livestock
Amaru	Quechua/Suni/Puna	3600 – 4400	Livestock, agriculture
Puno	*Altiplano*		
Camacani	Circunlacustre/Suni	3900 – 4000	Agriculture, livestock
Luquina Grande	Circunlacustre	3800 – 4100	Agriculture, livestock
Quishuara	Suni/Puna	3900 – 4200	Livestock, agriculture
Arequipa	*Dry western slopes*		
Coporaque	Quechua/Puna	3500 – 4200	Agricultura, ganadería

Source : (Tapia 1996), 105

The second study that deserves mention and which also corresponds to the PISCA project, is the "Agriculture and Livestock Technical Diagnostic of the Farming Communities of Arizona and Qasanqay" (Valladolid 1983). This work is the compilation of multidisciplinary studies around common research subjects, production activities and resource management in the two pilot communities selected in Ayacucho.

Results of the study correspond, to a large degree, with those of the first study. Both reaffirmed the rationality of traditional Andean agriculture, based on the management of

[7] The indicated source includes the community of Coporaque, in Arequipa, which was added after the project had begun when the work in Ayacucho could not continue due to the socio-political conflict situation from 1983 on.

diverse ecological zones, a wide dispersion of crop land plots and an ample diversity of species and plant varieties cultivated in each plot with the goal of confronting the elevated risk implied by agriculture in arid lands, on hillsides, and under generally adverse climatic conditions with risk of drought, frost and hail. What these findings provided was a much better understanding of the complexity of the problems faced by farmers and by researchers attempting to design and test technical solutions.

Unfortunately, the situation in the department of Ayacucho changed drastically soon after the start of the project owing to the rise of the Shining Path and their guerilla activities. The group originated in Ayacucho and soon the situation in both communities and in the university was affected as follows:

In the case of the university

- Field trips had to be stopped.
- The applied research work was abandoned at the Allpachaca experimental station which, with the exception of the germplasm bank, was burned by the guerillas. The latter, according to testimonies collected in the course of this investigation, was spared because it consisted of native materials considered by the attacking guerillas as the patrimony of the communities.
- A deep internal political division arose among the professors and researchers and among the students which made it impossible to maintain the existing multi-disciplinary teams amid the general climate of distrust .

In the communities:

- The pattern of land occupation changed completely as peasants abandoned their fields in a search for refuge in urban centers resulting from the general insecurity created by the presence of the warring factions in the countryside.
- Crops and livestock were severely affected by lack of care and attention.
- As in the university, community members were divided and an atmosphere of distrust and insecurity prevailed.

As a result, the PISCA project could not be continued in Ayacucho and in 1983 the coordinators transferred the research operations to Arequipa department where a new field research site was established in the community of Coporaque, in the Colca valley.

The PISA project, which started in 1985, was concentrated in the department of Puno, Peru. The pilot communities selected for this project are listed in Table No.4 in chronological order of their incorporation into the project.

6.4. Characterizing the agro-ecology of the Andean environment

Andean agroecological zones have been the subject of numerous studies and these have been well synthesized in (Tapia 1996) and (Tapia 1986). Table 5 shows part of a table

prepared by Tapia describing the *Suni*, *Puna* and *Jalca* zones of the Southern Peruvian *sierra*; the *Páramo* zone is not represented in the context of this study.

Table 4: PISA Communities and their agro-ecological zones

Community	Agroecological zone
Kunurana Bajo	Puna húmeda/Suni
Apopata	Puna seca
Luquina Grande	Circunlacustre
Viscachani	Suni
Jiscuani	Suni
Llallahua	Suni
Urac Ayllu	Quechua/Puna
Puna Ayllu	Suni/Puna húmeda
Carata	Circunlacustre/Suni
Anccacca	Suni
Santa María	Suni

Source: based on information from (Thomas, Babcock et al. 1989) and (Ayala Macedo, Dávila Briceño et al. 1989)

Table 5: Characteristics of the Suni, Puna and Jalca Agroecological Zones in the Sierra of Southern Peru

Characteristics	Suni	Puna	Jalca
Temperature annual mean (°C)	7	3,6	8
Altitude (m.a.s.l.)	3 600 – 3 900	3 900 – 4 800	3 000 – 3 800
Latitude	South, 10° S	South, 10° S	North, 10° S
Physiography	High plateaus and ravines	Highlands of mountain chains	High isolated or continuous mountain zones

Source: (Tapia 1996), 42

These characteristics vary considerably in areas close to Lake Titicaca [8] where proximity to the water acts as a thermal regulator and permits a much longer growing season (between 150 and 180 frost free days per year) and a reduced risk of harvest losses. While there is still some risk of frost and flooding or drought periods in this zone, they are an exception to the general conditions.

This system differs from the ecological map, published by the Oficina Nacional de Evaluación de Recursos Naturales (ONERN) which is based on the classification system of L. Holdridge as adapted by Joseph Tossi, working with the personnel at ONERN. The

[8] The term "circunlacustre" refers to the land surrounding Lake Titicaca, the largest of the Andean region covering nearly 6,900 km^2, 180 km in length at it longest part and between 50 and 60 km in width. It is located 3,812 meters above sea level, 16º South, between Peru and Bolivia.

map was published in 1965 and revised in 1980. This classification does not reflect the special conditions of the highly diverse tropical mountains characteristic of the central Andes of Peru hence the need for a more accurate representation of local conditions..

A second source of information for defining the ecological differentiation of Peru was the system proposed by geographer Javier Pulgar Vidal, who identifies six natural regions in the highlands of the Andes, out of a total of eight regions for the entire country (Pulgar Vidal 1946; Pulgar Vidal 1987).

The foundations for Tapia's zoning proposal began in 1980 as a result of experiences and observations derived from characterization studies and discussions with inhabitants of the farming communities selected to participate in the PISCA project. The differentiation and use of the proposed typology crystallized as the research progressed. Two key factors contributed: 1) the dialog between professors and farmers to clarify the farmer's concepts of high and low Quechua lands and of Puna lands; and 2) the elaboration of community land use maps in the Cusco, Puno and Arequipa pilot sites. Thus, the foundations for the concept of agroecological zones, a combination of ecological and agricultural indigenous knowledge, were developed and initially applied during PISCA. These were based on climatic characteristics, altitude and physiography, as related to plants and crop varieties grown by farmers. In PISA, the work was continued applying ideas of homogeneous production zones to local conditions as determined by soil and topographic conditions modified by human activity.

Later, during an IDRC supported sabbatical period, Tapia extended the classification to cover the whole country (Tapia 1996), 39-78, integrating sub-regions in which the geographical conditions of latitude and exposure are differentiated. It was evident that to be useful, the great ecological diversity in the Andes can only be classified using an approximation that reflects the different hierarchical levels (sub-region, agroecological zone, homogeneous production zones) but which, at the same time, integrates farmers' perceptions and use of that environment. The author of this zoning system notes that during the entire validation process (Tapia 1999), the contribution of farmers and professionals in the projects was decisive, particularly that of Oscar Blanco, Pierre Morlon, Efraín Molleapaza and Bruno Kervyn.

In both PISCA and PISA agroecological zoning was used as a tool to characterize the systems of land usage in the agricultural communities. Currently, students of regional universities and professionals at NGOs are using this zoning method increasingly in their thesis and development work. To date (1999), four theses have been published in the Universidad Nacional Agraria de La Molina using this classification of agroecological zones in the Andes. Similarly, the engineers of the Programa Nacional de Manejo de Cuencas Hidrográficas y Conservación de Suelos (PRONAMACHS) are also introducing this classification in their work nationwide.

Information on the use and application of this new classification system is being disseminated through exhibitions in meetings, seminars and workshops organized by NGOs like the Red de Agricultura Ecológica (RAE), Red de Aplicación de Alternativas al uso de Agroquímicos (RAAA), as well as through the postgraduate schools of various

regional universities, particularly those of Puno, Cusco and Cerro de Pasco. In the latter university, a course on eco-development in the Andes was created based on this agroecological zoning system. Today this typology is used in many studies that refer to the Andean world and require agroecological characterization (Ayala Macedo, Dávila Briceño et al. 1989).

Among the technical staff of the Consorcio para el Desarrollo Sostenible de la Ecorregión Andina (CONDESAN) there are still, according to Tapia (Tapia 1999), some doubt as to the applicability of this agroecological zoning method. Specialists want a much more highly elaborated methodology, still not available, but which could be built on the foundation of the proposed sub-regions, agroecological zones and homogenous production zones or environments. This is possible by employing tools such as geographical information systems to fill in detail and expand its application in a coordinated effort.

The rationale for creating a new typology specifically for the Andes based not only on standard geographic and ecological systems, but also on the perspectives of indigenous knowledge, responds to the need for a classification system sensitive to the diversity of mountain environments. It incorporates indicators of the way humans have adapted to the vagaries of this heterogeneity in climate, soils, water availability and vegetation cover. This classification represents a fundamental step towards a systematic development planning tool which includes the biophysical factors which explain differences in land use and management under diverse conditions. In addition, an interpretation is needed of the socio-economic reasons for different natural resource management regimes in regions with similar characteristics (Tapia 1996), 39. It is risky to promote modifications to production systems which have stood the test of time without first understanding the way they operate and the many interactions which determine their stability; albeit, often at a relatively low level of productivity.

The Premio Nacional a la Creatividad, a national creativity award, was created by the private construction company COSAPI to recognize important contributions to development in Peru. In 1995, a highly qualified jury selected the agroecological zoning system, and the research on native Andean crops, as creative contributions to land use in the Andes and to the improvement of the national food situation. The jury awarded the prize to Mario Tapia, the author of the zoning proposal which originated in the projects supported by IDRC. The spread of this agroecological zoning scheme is, without doubt, an outcome and impact of the projects IDRC supported.

6.5. Research and teaching at the Universities

Research focused on production systems at the different universities was closely linked to teaching and expanding course orientation and content. It also resulted in a large number of student theses and professional research papers. Within the context of the projects, research and teaching usually responded to one or more of the following goals:

- Modify the linear approach to increased productivity of specific commodities by introducing an integrated systems vision encompassing a more complete understanding of existing production systems;
- Integrate technical production aspects with socioeconomic considerations;
- Expand the curriculum of the agricultural sciences with a systems integrative approach and encourage greater interaction and complementary programming in research and education;
- Achieve greater integration among university trained professionals, their research results, farming communities, the public agricultural sector and regional authorities; and,
- Expose university researchers and students to FSR research methodologies and provide training opportunities for young professionals and students.

Awareness of the importance and potential of traditional products of the Andes is relatively recent. As pointed out by Blanco and Blanco (Blanco Galdós and Blanco Zamalloa 1995), until the mid-20th century, mention of Andean crops in formal research reports and records hardly existed. That situation has changed with the creation of the Programa de Investigación en Cultivos Andinos (PICA) in UNSAAC (Cusco) and with the work carried out in Puno at the predecessor to the current Universidad Nacional del Altiplano (UNA). From the beginning of the seventies, new research activities on Andean crops also appeared in the regional universities of Ayacucho, Cajamarca and Huancayo. The first external agencies to show interest and support work on Andean crops, according to the same authors (p. 29) were IICA, IDRC and GTZ.

This interest grew in the years prior to the initiation of the IDRC supported projects and continued, with a slight decrease, into the early nineties. Table No. 5 shows the number of theses on Andean crops completed in Andean universities, 1949 to 1991. Distribution of the theses by university, indicates a greater concern for Andean crops in the universities of the *Sierra* which is to be expected since they are native to the region. The exception was the UNALM in Lima, where 25% of the theses on Andean crops were presented.

Leaving aside theses on potatoes and corn, well known commodities of Andean origin, less than half the theses completed between 1949 and 1991 deal with what Blanco and Blanco describe as "forgotten crops". Of these 534 theses, the most studied crops were quinoa and tarwi (26% each), kiwicha (15%) and oca (12%).

Most of the theses on potatoes were presented at UNALM, followed by UNSAAC and UNA. The other Andean crops were scarcely studied in the UNALM. Theses on quinoa at UNSAAC were double the number at UNA while the latter university doubled the number of theses at UNSAAC on tarwi. The main lines of investigation focused on variety and germplasm improvement as well as other branches of genetics, together accounting for 231 titles or approximately a third of the references.

Table 6
Number of theses on Andean crops in the Peruvian universities
1949-1991

Year	Thesis	%
1949	1	0,09%
1950	0	0,00%
1951	0	0,00%
1952	1	0,09%
1953	2	0,18%
1954	6	0,55%
1955	3	0,28%
1956	1	0,09%
1957	0	0,00%
1958	1	0,09%
1959	0	0,00%
1960	3	0,28%
1961	3	0,28%
1962	4	0,37%
1963	5	0,46%
1964	11	1,01%
1965	9	0,83%
1966	11	1,01%
1967	9	0,83%
1968	20	1,84%
1969	21	1,93%
1970	22	2,02%
1971	32	2,94%
1972	30	2,76%
1973	35	3,22%
1974	38	3,50%
1975	46	4,23%
1976	52	4,78%
1977	69	6,35%
1978	60	5,52%
1979	49	4,51%
1980	42	3,86%
1981	63	5,80%
1982	44	4,05%
1983	52	4,78%
1984	56	5,15%
1985	46	4,23%
1986	49	4,51%
1987	33	3,04%
1988	50	4,60%
1989	52	4,78%
1990	44	4,05%
1991	2	0,18%
s.d.	10	0,92%
Total	**1087**	**100%**

Source: (Blanco Galdós and Blanco Zamalloa 1995)

The importance of IDRC support to the research in Andean crops can be observed in the bibliographical analysis of Rivera Romero (Rivera Romero 1995). Numerous entries report on work carried out within the IDRC supported projects and the associated universities by researchers who participated in them. This bibliographical study contains 704 references on Andean crops and includes research reports, articles in scientific journals and books. It is complementary to the compilation of university theses. The period covered in this publication is 1960-1990, which partly coincides with the period studied by Blanco and Blanco.

6.5.1. A shift in teaching from individual commodities to production systems

At the start of the projects, important system characterization work was undertaken to systematically document and understand the production practices of individual farmers and their communities. As the results of this work was assimilated and interpreted by

dedicated university teachers, the content and new insights were integrated into the courses they were leading from various disciplinary perspectives. Eventually independent courses from a systems perspective were designed and introduced into the agricultural faculty curriculum at a number of universities. Several professors developed such courses and in some cases, the authors were invited to other universities to present their courses. An idea can be gained of the scope of this change in university teaching focus from the following descriptions:

- In the UNSAAC in 1993, Alcides Alfaro, a PISCA team member in Cusco, published (Alfaro 1993) his course notes in the form of a manual which organized and systematized accumulated experiences from the project. The production systems course has been continued by Pompeyo Cosio who earlier worked as a technician in PISCA from 1980 to 1983;
- In the UNA, Arturo Vásquez, a PISCA team member in Puno, was the first to deliver the production systems course in the Post Graduate School. He was followed subsequently in alternate years by two former IDRC project scholarship holders Alipio Canahua (Chapingo, México, 1987-1989) and Roberto Valdivia (CATIE, Costa Rica, 1987-1989) from the earth sciences, and by Jesús Tumi, a previous Social Sciences student in the Post Graduate School. This school is currently directed by Angel Mujica, another project scholarship holder for graduate training at Chapingo;
- UNA offers a Masters degree with a specialization in rural development and Andean crops with a strong systems focus that relates back to IDRC project support;
- The aforementioned course in UNA under Roberto Valdivia, is co-sponsored by the Centro de Investigación de Recursos Naturales y Medio Ambiente (CIRNMA) which was created by ex PISCA and PISA team members and was the executing body for the Sustainable Highland Agriculture (PRODASA) project, supported by IDRC after1993. CIRNMA is also a member of CONDESAN;
- In the Universidad Autónoma Tomás Frías (UATF) of Potosí (Bolivia), José Luis Lescano, who was the Puno team director of PISCA and PISA, delivered a course of studies on "Production Systems" based on a manual which he authored. The course manual was then published by the Corporación Departamental de Desarrollo de Potosí (CORDEPO) financed by the United Nations Development Program (UNDP);
- In the Universidad Mayor de San Andrés (UMSA), in La Paz, Bolivia, Professor David Morales, the director of the Patacamaya experimental station of IBTA during the period of IDRC support for quinoa production systems research, is in charge of the production systems course, although the subject appears to be somewhat isolated within the academic curriculum.

Lack of material from contacts in Bolivian universities does not allow greater identification of project imprints which might indicate the influence of IDRC support apart from the two cases already mentioned. There was no direct IDRC support to the Bolivian universities but regular contacts with Peruvian researchers in UNA and through network meetings sponsored by IDRC have resulted in a degree of influence.

In the opinion of Mario Tapia (Tapia 1999), and from observations and contacts made by the project reviewers, IDRC contribution to expanding the universities' training materials, research and courses can be summarized in three categories:

- Professional training of students in systems approaches and the support of field work carried under the on—farm conditions in agricultural communities;
- Support for professors in their research into the conditions of agricultural communities and provision of opportunities for visiting and exchanging experiences between Andean universities, all of which led to greater coordination and conceptual advances in the universities;
- Influence on the curricula of the faculties of Agronomy and Livestock.

These initiatives correspond with specific project objectives and related budget allocations for training at various levels, for travel to visit other researchers and research sites and for participation in conferences related to Andean production system improvement problems. For example, in each of the PISCA and PISA phases, key activities mentioned explicitly in project documents and reports include: improved training for students from the Andean region; publish and distribute information; train students in community level research; train community members in improved methods; develop training for farmers and staff; and, train and collaborate with professionals, technicians, farmers, and local government representatives.

6.5.2. Articulation of production technology and socioeconomic aspects

The influence of the systems approach can also be observed in other faculties, especially in the social sciences (Administration, Anthropology, Economics, Sociology). In this case, the influence, rather than flowing from the projects to the universities, is in the opposite direction, from the universities to the projects. This corresponds with the evolution of the projects themselves which, at the beginning, viewed the problem of crops and livestock from the perspective of the faculties of agricultural and biological sciences. Once concerns broadened to production systems and peasant livelihoods, it became evident to the researchers that participation from the social sciences was imperative. At this point in time, social science specialists were generally employed by the universities as the NGOs were only beginning to appear and employment of social scientists by the public and private sectors was still limited.

Some interview comments reinforce this observation. For example, the directors of PISCA in the UNSCH in Ayacucho and the UNA in Puno during the early Eighties, both agronomists, indicated that they came into direct contact with the contributions of social scientists as a consequence of the diagnostic and characterization work in the pilot communities. The discovery of the contribution from these disciplines contrasted with the generally negative opinion they had of social scientists as political activists and agitators of the masses. These agronomists and other agriculture professionals came from a training background that was more experimental and less directly involved with the

realities of communities and their environs. Their contact with professionals of the social sciences lead them to a greater engagement with the rural population and to opening their research perspectives towards finding better responses to the real needs of the research subjects from their perspective. They also gained a greater appreciation of the complex management decisions farmers must take in assessing whether the recommendations of the specialists from the universities would serve their interests.

6.5.3. Changes in the Curriculum of the Agricultural Sciences

The third goal was addressed principally at the postgraduate level. This is not surprising, since integration of ideas and a systems understanding assumes a base of knowledge and techniques normally presented in more basic training. This requires specialization in a subject and a pedagogical approach to consolidating the knowledge as a firm foundation for later application. For example, in UNA in Puno, the systems approach is taught at the psot graduate level within the predominant framework of rural development and Andean agriculture specialties. However, some differences were noted in the specialization on Andean livestock and economy that are principally thematic in focus. Both the course syllabi and the thesis subjects give evidence of these characteristics. The program profiles are found in the following boxes.

Universidad Nacional del Altiplano (Puno)
Professional Profile of Magister Scientiæ in Andean Agriculture

Objectives:

- Formulate, implement, execute and interpret the process of scientific and technological research for the development of sustainable agriculture.
- Develop and present appropriate and competitive technological alternatives, from the agroecological and socioeconomic point of view, for different hierarchical levels (family, community, region and nation).
- Guide, direct and participate in the sustainable management and improvement of renewable and strategic natural resources for agricultural development.

Specific courses:

- Agroecological management of soil and water
- Agroecological management of pests and diseases
- Andean agricultural systems
- Sustainable agricultural systems
- Andean agroecosystems
- Ecological livestock systems
- Watershed management
- Agro-forestry systems

Universidad Nacional del Altiplano (Puno)
Professional Profile of Magister Scientiæ in Rural Development

Characteristics:

- Up-to-date on approaches, policies and rural development strategies
- Possesses a systematic, holistic and interdisciplinary approach
- Knows and respects the rural inhabitant and values Andean knowledge and technology
- Concerned for the sustainable management of natural resources and the environment

Specific courses:

- Culture and development
- Sustainable production systems
- Development theories and policies
- Population and development

The initiatives to modify the agricultural sciences curriculum towards an integrative systems approach tacitly corresponds with the objectives of the IDRC supported projects. The above information provides substantial evidence of this outcome and IDRC influence.

6.5.4. Linking research results with development objectives

The objectives and approaches of the IDRC supported projects had a strong focus on increasing small farm production and income and improving rural community wellbeing. Changing the universities was not a direct objective although aspects of university teaching related to production systems were expected to be strongly influenced. Efforts were made to integrate research results, and experience acquired in university studies, with the activities of development agents in the communities. In line with the social function theme of the time, the universities were considered by IDRC to be research agents for change which could be encouraged and developed through support to applied research projects. While there was an almost total lack of communication between the agriculture faculties and the social sciences in research and promotional work at the beginning, in practice a combination of the contributions from both evolved when focused on applied problems in the real life situations encountered in the pilot communities.

Introducing these new concepts was not always easy nor always successful. In attempt to transplant the positive disciplinary integration experience in Cusco and Puno, the PISCA

project tried to introduce this experience in Arequipa when project activities in Ayacucho had to be abandoned. Personnel from PISCA transferred to positions in research and teaching at the Universidad Nacional de San Agustín (UNSA) and the Universidad Católica Santa María (UCSM) de Arequipa. In fact, what was attempted went beyond the experience in Cusco and Puno and the proposal to create an integrated "agricultural sciences" faculty which would include elements of both the natural and social sciences did not prosper and was strongly opposed.

Various hypotheses have been put forward on the reasons for this failed initiative which illustrate some of the pitfalls often encountered in any effort to introduce change in entrenched organizational and conceptual structures. One argument put forward is that the concept was unsuccessful because the sponsors were not local but rather from "deep Peru",Cusco and Puno, the indigenous heartland. Another was that in the local perception and judgement, the initiative was driven by external influences (political party, international technical cooperation) and thus a threat. With respect to joining in collaborative field work there were criticisms that the distance was too great between the university and the selected community (Coporaque in the Colca Valley four hours away). Finally, in the focus group discussion in Arequipa, an opinion was expressed that the difficulty in creating a mechanism to integrate the various disciplines at the university level may have been due to the resistance of the existing faculty heads (Agronomy, Biology, Livestock) who saw such integration as a threat to their power base.

Unlike in the cases of the UNA in Puno, the UNSAAC in Cusco, the UATF in Potosí and the universities of Arequipa in which gradual changes to curriculum, focus and structure was attempted with varying degrees of success, the Colegio Andino del Cusco offers an example of an integrated program developing from the beginning.

The Colegio Andino del Cusco, an autonomous graduate school, promoted a holistic approach in various postgraduate courses, particularly in the sustainable environmental management program that resulted from the evolution of previous courses focused on Andean rural development. The person who developed the course and is currently the director of the Colegio, Annette Salis, was a PISA project researcher in Puno while working on a doctoral thesis which she later completed in France (Salis 1987). Salis returned to Cusco to advise the NGO, Centro de Desarrollo de los Pueblos – Ayllu (CEDEP-Ayllu)[9], in Písac (field site of PISCA) and then joined the Colegio Andino[10] as a teacher and researcher.

The objectives of Colegio Andino were formulated as follows:

[9] CEDEP-Ayllu was established in 1984 and began work in Písac, managing, in a way, the inheritance of the PISCA project.

10 The Colegio Andino, founded in 1986, is part of the Centro de Estudios Regionales Andinos "Bartolomé de las Casas",established by the Orden de los Predicadores (Dominicans) in Cusco in 1974.

Colegio Andino Course Goals:
"Environmental Management and Development"

- Become acquainted with, and understand, environmental potential, methods of utilizing Andean and Amazonian resources and the productive and cultural rational of their actors in order to formulate development projects which integrate specialties included in holistic and sustainable resource management that are "technically appropriate, economically viable and socially acceptable".
- Predict and evaluate the environmental impact of the principal activities that produce alterations in the environment, emphasizing the following sectors: forest extraction and resource mining, irrigation projects, road projects, small industry, tourism and urban development.
- Plan economic strategies or the implementation of services and infrastructure, from the point of view of public or private organizations, in response to new populace needs and reduce the impact of economic activities on the natural environment.

Colegio Andino Course Goals:
"Andean Regional Development"

- Become acquainted with contemporary approaches to the principal themes in regional development.
- Situate Andean regional development studies within the context of interdisciplinary inquiry with special emphasis on the natural environment and the cultural dimensions of regional organization.
- Study the current political contexts for definition of and for production in the Andean region, in particular those based on traditional collective expression and demand a high degree of social and economic innovation from the indigenous peoples of the Andes.
- Equip the student with the most advanced techniques and provide access to global scientific knowledge and to the discussion and elaboration of theories and practices related to regional development.

These statements of the topics and goals pursued by the Colegio Andino show the influence that systems analysis applications developed and promoted under the umbrella of the IDRC supported projects has had in the region. This influence is led by an individual who participated in the projects and has been the director of the Colegio Andino for a number of years. In addition, the IDRC related influence reaches to many organizations, local governments, NGOs, etc., which depend on graduates of the Colegio

Andino to lead there programmes and realize their development goals. This is the case, for example, of the members of the Consorcio Sur-Andino, formed by graduates of Colegio Andino participating in a network of universities and NGOs in four non-capital cities of four countries in the region (Arequipa in Peru, Cochabamba in Bolivia, Arica in Chile and San Salvador de Jujuy in Argentina).

We should emphasize that this influence is combined and shared with other active participants and sources of ideas, like the French school of systems analysis in which Annette Salis was trained, fundamentally during her doctorate work. This is also the case with other staff and researchers at Colegio Andino who were not involved directly with the IDRC supported projects analyzed in this study. Nevertheless, IDRC there is general agreement that IDRC support created the environment and foundation for the development of these later developments

6.5.5. Training opportunities

A key objective in most IDRC projects was to expose university researchers to FSR research methodologies and provide training opportunities for young professionals and students. The principal activities and outputs in terms of courses attended, and papers and theses completed are listed in Annex No.6. These were at several levels including professional upgrading short courses, graduate studies and undergraduate thesis support.

It must be noted that training and thesis support for women was limited in both PISCA and PISA. In the former, women held only two out of thirty scholarships for thesis research. In PISA, there were two female agronomy technicians and eight scholarship holders in the field of nutrition out of a total of forty students who participated in the project during the first four years. According to Tapia (Tapia 1999), there were several reasons for this low level of participation by women. One was the high percentage of men in the agronomy and livestock fields so there were few women to choose from and second, the work required permanent residence in the pilot communities, a condition that was difficult for most female students and professionals, as well as their families, to accept. Efforts were made to involve more women in the developing cadre of systems oriented professionals but progress was less than might be desired.

6.5.5.a. Workshops and Exchanges for Farmers

IDRC provided support for the following activities through the PISCA project and in collaboration with the Instituto Indigenista Interamericano:

- Workshops for farmers of Peru and Bolivia in Puno and Cusco, 1983;
- Workshops for Peruvian and Ecuadorian farmers in Cajamarca, 1984.

A meeting of the farmers participating in the PISCA project was held in Cusco in 1982. At the local level, many meetings, field days and trips were organized over the entire PISCA and PISA projects period. Many women farmers were involved in these courses and workshops in contrast to the lack of balance at the professional level.

6.5.5.b. International conferences in the region and their impact

The projects provided support for the first meeting on genetics and phyto-improvement of quinoa in Puno, 1980, attended by specialists from Chile, Bolivia, Canada and Peru. The Andean regional meeting on genetic resources, held in 1981 under the auspices of FAO and IICA, also received partial support from IDRC funded projects.

Another significant IDRC contribution came through its support for the series of International Congresses on Andean Crops beginning with the first held in 1977 in Ayacucho to the eighth held in Valdivia, Chile in 1994. These conferences have played an important role in promoting research and genetic resource conservation in a wide range of institutions in the Andes region and especially in the universities of southern Peru. Tapia has prepared an historical summary of these conferences which he presented at the 9th Congress held in Cusco in 1997 (Tapia 1997).

6.5.5.c. Other Activities

Various other training activities arising from the IDRC supported projects can be mentioned including:

- Meeting on "Evolución y tecnología de la agricultura andina" in the farming center in Wasinchis, Cusco, 1982.
- Course for INIA staff on the systems approach held in 1986 at the field station Chuquibambilla, Puno.

6.6. Project footprints in the communities

An important contribution of the projects was that of getting researchers out of the experimental stations and universities to become acquainted with the reality of the countryside and agricultural communities. This took the form of joint efforts organized between professors, students and community families. Numerous individuals were encountered by the reviewers in the course of interviews—be they community workers or leaders, professionals or professors, active or retired—who remember and value the learning experience in the field dealing with characteristics of peasant agricultural production systems of Andean crops or livestock.

At the same time, some of the comments in community focus group interviews were not as positive about the experience. A few participants felt that the communities had become the "guinea pigs" of the university students and benefited little from their presence there. This was more evident in the communities of Cusco than in those of Puno; the data for Ayacucho, Arequipa and Bolivia is insufficient to comment on this point. In Písac (Cusco), this issue was addressed during a meeting with community members in Sacaca where it was suggested that the university students had come and applied what they had learned in the university, not returning to the community later to contribute. And further, that thanks to the experience and knowledge they had gained in the community, they had been able get better jobs and continue in other careers.

Some degree of dependence can be seen with respect to the completed projects. For example, in Quello Quello (Cusco), the presence of a former participant in PISCA during a visit for this evaluation, raised questions and hopes about the possible resumption of project operations in the region. This could have several interpretations. One is that the villagers received direct positive benefits from the interaction which they wished to continue. A second might be that experiments were subsidized in a way which increased participants' incomes. Or, it could be that both of these possibilities were raising expectations.

In Písac (Cusco), peasants were encountered who remembered the names of PISCA personnel; they located successful operations as well as abandoned constructions. Some of these community members work today with a local NGO, Centro para Desarrollo de los Pueblos - Ayllu (CEDEP-Ayllu), among the members of which are ex-participants of PISCA. In the Sacred valley of Vilcanota, located in the neighboring districts of Taray and El Salvador, extrapolations were encountered of experiences gained in the four initial communities (Amaru, Cuyo Grande, Paru Paru and Sacaca). For example, the planting and use of eucalyptus (*Eucalyptus globulus)*, which was not to be found among the traditional crop production activities and was introduced by PISCA. This introduction took place through a small tree nursery that was created by the project and is the only one still in existence and operating in the micro-region.

As evidence of the change in this same area, the abandonment of the intercommunal center constructed at the beginning of PISCA in Quello Quello seems to correspond with the presence of new trades and small enterprises (bakery, carpentry, etc.) which arose in the communities whose members had received training at the center. Just as with the continuation of work initiated in the aforementioned nursery, these local activities reflect an impact of the projects over time.

In Santa María, in Jiscuani and in Apopata (Puno), some of the older community members and leaders remembered the names and participation of professionals, professors and students of the PISCA, PISA and PRODASA phases. The youngest members drew attention to terrace recuperation works and erosion control ridges on neighboring hillsides, and to crop rotations, indicating they had participated with their fathers in the construction of these land-forming activities. These works are an example of sustainability, being an inheritance from the past and reproducible, either by the same community or neighboring ones. In fact, in an interview, the director of an NGO in Puno that works in the same areas of the pilot communities stated that the experience with terraces, ridges, crop association and rotation and assessment of Andean grains that had been carried out in the pilot communities had spread to other communities of the different micro-regions. The case of Santa María was especially mentioned because five neighboring communities copied its experience. In the PISA project, construction began with 3 ha of terraces and currently more than 30 ha have been rehabilitated in this community (Tapia 1999 144).

On the other hand, the above mentioned experiences with terrace reconstruction are still incomplete even though they have survived over time. Various studies indicate that the

potential for further reconstruction is still enormous, reaching up to one million hectares for all of Peru (Masson 1984; Masson 1984; Masson 1987). For additional details on the experience of terrace recuperation, see (Morlon 1996), chapter 4.

In the same communities in Puno, first aid, carpentry, communal store and meeting hall services are available in the locales constructed under the projects. This is in contrast to Quello Quello (Cusco), where the locale has been abandoned. In an attempt to interpret this difference, a key source offered the following hypothesis. In the case of Cusco, since the locale had been intercommunal, it was perceived as part of the project for promotional and training activities and not as a shared responsibility between the communities. In the case of Puno, since the locales were constructed by individual communities, a sense of ownership arose, both then and now, which links the communities to the value of using the locales.

On the Bolivian shoreline of Lake Titicaca, in the context of the Highland Farming Systems (Bolivia) project (1991), IBTA promoted the introduction of greenhouses (Paredes Huayta and Gómez Gómez 1986) for family and community production of vegetables to improve the diet in the rural areas as well as for sale in urban markets. The NGO CIRNMA of Puno, with IDRC support in the subsequent Binational Resource Management (Peru/Bolivia) project (1997), introduced lessons from the Bolivian experience with greenhouses in Puno and continued support for the Bolivian work after the demise of IBTA. According to Miguel Holle, this technology is an evolution of the experience of greenhouses introduced on the coast of Peru north of Lima by the Japanese. The technology was brought to the Puno area by several NGOs but proved too sophisticated and expensive to be practical on the *altiplano*. The Bolivia and Peru initiatives, however, adapted it to local conditions and construction materials easily available to small farmers. There is still some question, however, about the ability of small greenhouse operators to compete in urban markets against more highly capitalized commercial operations.

6.7. Project footprints in public sector activity

Evidence of project influence in public sector agricultural extension and rural infrastructure construction activities was clear. In the various places visited, references were made to persons currently working in government programs with a watershed or integrated rural development perspective as well as to agreements between these programs and university faculties of agronomy. Fundamentally, these are programs that share the contemporary concern for natural resource management and for environment themes. These themes represent a continuation of those studied with the support of IDRC. It can, therefore, be postulated that the current projects are derivations of the earlier ones, and that this inheritance is characterized by the professionals that held key positions in the previous projects. Some activities and organizations illustrating these links are as follows:

- The Instituto Nacional de Investigación Agraria (INIA) was a counterpart of several of the projects studied. The current director of the Andean crop program, Saturnino Marca, participated in the PISCA y PISA projects in Puno. INIA (which has also used the acronyms INIPA and INIAA) has been the government agency for testing and disseminating agricultural technology. However, it considers the crops and livestock species as individual components and, despite all attempts at change, its approach is determined more by individual disciplines and crops than by a systems approach. According to our main source (Tapia 1999), an integrative approach has not been achieved in the INIA, particularly at the central level, although it is possible to observe that the concepts and progress achieved by the PISA project have had some impact at the individual level of the researchers and in the training of students in the rural development specialization at the Universidad Nacional del Altiplano, in Puno.

- The Programa Nacional de Manejo de Cuencas Hidrográficas y Conservación de Suelos (PRONAMACHCS). This program, begun in 1981 as a soil conservation program, was given responsibility for the proper management of water and soil resources in interandean valleys. Later, from the management of natural resources, the program shifted to managing these resources at the watershed level. Subsequently, the management of protective forests was added to its responsibilities, that is, those forests that serve for water retention and as a covering layer in the upper slopes of the valleys. Still later, the program was entrusted with the promotion of agroforestry at the community level for the protection of the soil, as an energy source and construction material or the manufacturing of furniture.

  Finally, the mission of constructing hydraulic infrastructure in the Sierra was added as well. Under this program more than 30,000 ha of slow forming terraces have been set up throughout the Peruvian Sierra. The source of this information (Tapia 1999) does not try to claim that the extension of the program is due to the influence of the projects supported by IDRC; he does, however, indicate that the IDRC supported experiences are recognized in the area as a stimulus that helped relaunch the terrace reconstruction programs. Gradually the working hypothesis of the projects has been accepted in the sense that the terraces are the best alternative for expanding the arable land with the lowest risk for production, both by creating microclimates and their improved ability to retain humidity and reduced exposure to soil erosion.

- The Plan MERISS, (Mejoramiento del Riego en Sierra y Selva) or Irrigation Improvement in the Sierra and Rainforest, was created in the 1980s with the support of German technology cooperation. The director of this plan in Cusco, Walter Olarte, who was linked to the PISCA project in the public works department, states that he cannot respond to a demand for infrastructure construction at the regional level without reference to the economic, social and environmental context in which the work is to take place. This same director points out that this point of view arose from his experience acquired in PISCA.

- The Programa MARENASS, (Manejo de Recursos Naturales en Sierra y Selva) or Natural Resource Management in the Sierra and Rainforest, is a program begun in 1997 in communities of the departments of Ayacucho, Apurímac, Cusco and Madre de Dios. The program allows communities to directly contract the personnel of their choice for technical assistance and for crop and livestock management training with funds that were administered in the past by state agricultural extension agencies. As with the previously mentioned programs, MARENASS employs personnel that worked and were trained in projects supported by IDRC and reflects an integrated approach to natural resources with the addition of the dimension of direct responsibility of the communities in the administration of their technical production support operations.

In Puno, since the creation of the postgraduate school of the UNA, agreements with public and private natural resource sector agencies have been developed in order to bring students to the countryside as fieldworkers and to debate proposals of regional development. It should be mentioned that the postgraduate school was created at the conclusion of PISA and hired professionals trained in that project. These professionals imprinted their systems perspective of Andean agriculture and rural development on the content proposal for this postgraduate program.

In Puno as well, the Proyecto Especial Lago Titicaca (PELT) [11] continues to promote the recuperation of *waru-waru* [12], PISA tested crop rotations or associations, the use of aquatic reeds from the lake as animal feed, the processing of traditional products and commercialization adapted to market demand—all in accordance with a systems vision applied according to the local agroecological activities and conditions. Once again, several professionals trained or participating in the projects supported by IDRC are working in the activities run by PELT. Two examples are Agricultural Economist Edwin Zuñiga who received his Masters degree with support from PISA and Alberto Lescano who worked in PISA and continued on with PELT in the livestock area.

Other experiments and initiatives with connections to or influenced by IDRC supported work worth mentioning are as follows:

[11] This is a binational project between Bolivia and Peru, initially supported by the European Union and currently financed by both countries. A related but separate project has been funded since 1983 by the Cooperación suiza para el desarrollo (COSUDE) under the name of Programa interinstitucional de *waru waru* (PIWA).

[12] "…giant furrows, 4 to 10 m wide by more than 100 long and 1 m high, which (facilitate) drainage, (increase) the fertility of the soil and (produces) a mirror of water that (protects) the plants against hail and frost. This technology, invented in 1300 BC, is found extended over 142 000 ha. Recent investigations have demonstrated that it permits a yield of potatoes up to 40 percent higher than those of hillsides or the prairies" (Mujica 1998). For more information on this technique in general, see (Palao Berastain 1992; Palao Berastain 1992; Palao Berastain 1992; Palao Berastain 1992), (Morlon 1996, 234-247) and (Tapia 1996).

In Cusco, the heads of the prefecture [13], the regional department of the Ministry of Agriculture, the Andean crops program of INIA and the Plan MERISS all took part in the projects previously supported by Canada. This facilitated the coordination of activities and maintained a team spirit beyond that found in formal institutions and arrangements;

In Písac (Cusco), the NGO CEDEP-Ayllu, with assistance from the Plan MERISS, was able to the dam a high lagoon which will provide a permanent source of irrigation water for sprinkler systems in the four former PISCA pilot communities of the watershed. This project is similar to one currently in operation in the community of Taray (in Cusco as well) supported by the local government with advice of the CEDEP-Ayllu team both of which included members influenced by PISCA.

The PISCA project was closely connected with the NUFFIC project, supported by the Dutch Government in Cusco and Puno. Among these relations and interactions the system of working in communities and the socio-economic analyses developed by Ricardo Claverías for both projects stands out. The research work on Andean crops shared results and experiments between the two projects.

The COPASA project on food security in the Colca valley (Arequipa), supported by the German agency GTZ, followed many of the methods that had been developed in PISCA and PISA because several of the nutritionists that worked in the projects supported by IDRC were later technicians in COPASA.

The analysis of the Bolivian case is more limited because the support of IDRC for these projects was channeled solely to the public agricultural sector via the Instituto Boliviano de Tecnología Agropecuaria (IBTA) and concentrated, at the beginning, on quinoa. This experience is related in the description of the projects in section 3 and in the case study on quinoa in Bolivia.

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6.8. Footprints in the activities of NGOs

During the internal unrest in Peru (1980–1995), there was a proliferation of promotional NGOs. This was related to the difficulties in the countryside which affected the academic research and teaching projects of the universities as well the extension and technology transfer work of the public agricultural sector. The NGOs, despite working constantly in the crossfire of subversion and repression, were able to act with greater flexibility in this situation and received substantial external financial support.

[13] The prefecture is the administrative and political unit responsible for the territory of a department. Its official is called a prefect and is the top departmental authority.

This rapid growth of the NGO sector later led to the formation of thematic or regional consortiums through which many of these organizations were able to integrate activities and link with universities, public sector institutions and businesses. The consortium mode would be one of the pivot points of national and international cooperation in the nineties.
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6.8.1. In Cusco

In Cusco, for example, CEDEP-Ayllu, heir to the tradition and part of the personnel of PISCA, contributed to the creation of the Coordinación Intercentros de Investigación, Desarrollo y Educación (COINCIDE) which is organized regionally by five NGOs of local and regional scope. At the end of January 1999, COINCIDE invited the new municipal authorities of Southern Peru to the "Festival de la Concertación",or "Festival of Consensus" in order to learn about successful experiments in coordination and consensus from the districts and provinces.

6.8.2. In Puno

In Puno, interviewees highlighted the collaboration and synergy that exists between the UNA and INIA, and between CIRNMA (heir of the PISCA and PISA projects), the Centro Privado para el Desarrollo del Campesinado y del Poblador Urbano Marginal (CEDECUM), the Centro de Investigación Educación y Desarrollo (CIED) and with the Cooperativa Americana de Remesa al Exterior (CARE). The learning and training behind this inter-institutional coordination dates from the experience gained in the projects supported by IDRC.

6.8.3. In Ayacucho

In half a dozen local organizations in Ayacucho, numerous followers can be found of academic systems training acquired during years of community work related to studies in the UNSCH. These organizations are: the CCC, Peasant Training Center, in existence since 1965, twelve years before the commencement of PISCA; IPAZ, Institute for the Promotion of development and Peace; TADEPA, Workshop on Andean Promotion; CEPRODEP, Center for Municipal Promotion and Development; IER-Arguedas, José María Arguedas Institute of Regional Studies; and, CIDRA, the Inter-institutional Committee for Rural Development of Ayacucho.

The relationship between university functions and the development of NGOs in Ayacucho is very clear. The reopening of the UNSCH in 1959, carried a specific mandate for the university to confront regional problems via three functions: applied research, teaching/training and social influence. This resulted in the design of an integrated training

plan for "rural engineers" and establishment of the model fund for Allpachaca (1964)(the UNSCH experimental station) in order to work in conditions comparable to those of the farming communities. Here the CCC was created with the goal of organizing training sessions for community leaders. Quite soon it became clear that there was a profound difference between the group dynamism of leaders assembled in a motivating learning environment and their subsequent dispersion as individuals in isolated communities. Back in their own milieu, they found the population did not experience the same motivation as their leaders, the environmental and productive conditions were heterogeneous in relation to the technologies taught, and teaching material was almost nonexistent and, where available, ineffectual owing to the low level of schooling among the adult population (especially among women).

On the initiative of Julio Valladolid, accompanied by a team of teachers, (among them Carlos Arbizu and Fernando Barrantes, both concerned with subjects linked to Andean crops and the preservation of germplasm), the PICA Andean crops research program was created in 1974. In 1977 when the UNSCH celebrated the tri-centennial of its founding, it hosted the First Congreso Internacional de Cultivos Andinos with IDRC support.

With the support of PISCA, just beginning in 1979 after two years of discussions and negotiations, the UNSCH team selected two pilot communities in which to work: one close to the main road, San José de Arizona, and the other, Qasankay, hours away from passable roads. A more continuous involvement with the communities was envisioned to resolve the problems of continuity and impact in the earlier experiences. The tasks were begun with a diagnostic of the current reality in the communities and a goal to return the knowledge gained to the farming communities.

Unfortunately, the operations of the Shining Path guerillas in the countryside and conflict with the army from 1983 on interrupted this agenda for linking the university and the countryside. Although the experimental installations of Allpachaca were destroyed by the Shining Path, and the livestock killed, the germplasm bank was not touched. In interviews and the focus group discussion in Ayacucho, comments confirmed that this selective action had its foundation in the ideology of the guerillas who saw the improved livestock (non-Andean species) as foreign to the Andean reality but valued the content of the germplasm bank as authentically indigenous. The collection work and use of the germplasm through peasant banks were never a target of Shining Path operations nor subject to reprisals given the perfect identification between the rural population and their local germplasm banks.

After years of internal unrest and damage caused in the area, it was the NGOs that have recuperated best. While the principal university actors still seem to be divided between positions that favor either the indigenous or Occidental rationality applied to agriculture, the NGOs demonstrate a position that takes into account the interests of the rural inhabitants that benefit from the projects. This was confirmed by the focus group and some of the interviews in which the university was never identified as the principal agent of new ideas and projects for the agriculture sector in Ayacucho. Even the university representatives in charge of the Faculty of Agricultural Sciences (dean, director of

research, chief adviser) did not claim or express an opinion on this role. In the case of Ayacucho, therefore, the initiative now seems to rest with the NGOs.

6.8.4. The Community Centers

The construction and organization of agricultural community service centers was an initiative originating from the PISCA project and repeated in the different regions. In the first period, under PISCA, the following centers were built:

- Wasinchis which served the four communities in the Písac (Cusco) zone;
- Luquina Grande, in Puno;
- Arizona and Qasanjay, of smaller dimensions, in Ayacucho;
- Coporaque (Arequipa), a few rooms were set up in the municipality.

At the time, the idea was to create a multi-purpose infrastructure, essentially for seed storage, meeting rooms and other services.

Under PISA the following centers were built in Puno:

- Community Center in Lallagua, still in use and expanded with a health center, community coordination office, mothers' club, community meeting hall, and a sports center;
- Community Center in Santa María has served various purposes: store, carpentry shop, seed store, dormitories for technicians, tool shed, and mothers' club;
- Community Center of Apopata has served for the last twelve years as a first aid post, alpaca fiber purchase and storage facility, and dormitories for technicians, visitors and researchers. The experience of this center has been replicated in five other districts in the region.
- Communal Center in Kunurana Bajo, constructed a community hall and the infrastructure for a cheese factory which is currently in use;
- Community Center of Jiscuani, with a medical post, mothers' club, office and dormitory, has been used for numerous activities.
- Service Center of Ancacca, includes storage for tools, coordination center and potato seed storage with a capacity 20 mt.

This infrastructure has served not only as a warehouse and focus for the organization of services in the communities, but in many cases it has allowed them to have access to various types of support from the government and other institutions.

Mario Tapia (Tapia 1999), a great defender of the usefulness of these centers during the course of the PISCA and PISA projects, firmly believes that "their use and expansion are the only way to move toward an organization of the relationships between communities, other institutions and, above all, the market" (Tapia 1999).

6.9. Footprints in the work of professionals

Other experiences that reflect the impact of the projects are those in which professionals participated in positions of responsibility and who continue, in one way or another, to work with concepts, models and methods applied in the projects or acquired through associated training.

In NGOs, the university and in private companies, traces are to be found of the professionals who worked in the projects. For example, Adolfo Achata, in CIED and who worked in PISA during the transition years under the direction of various coordinators, mentioned the value of the integration between research and development both in his work as a promoter in CIED and in his Masters level teaching role in agroecology at UNSA. He indicated that he learned the value of integration and experimented with it in the framework of the PISA project.

Guillermo Zvietcovich worked in the post-production projects of PISCA in Puno and assumed the national coordination of the project in 1985. Together with his wife, who was also a project participant, he has created and developed a quality control laboratory for agricultural and agroindustrial products [14] in Arequipa which employs over thirty people eighty percent of whom have professional degrees. The laboratory, called Zvicor, has agreements with the universities of San Agustín de Arequipa, UNALM, and Del Pacífico, Lima. This laboratory also produces inputs for organic agriculture. In addition to these activities, Zvietcovich has established an NGO, IDEMA, the Institute for the Defense of the Natural Environment (IDEMA), which promotes family gardens in peri-urban zones and organic or ecological agriculture in rural areas. This NGO receives, amongst others, financial support from the Peru-Canada fund.

Also in Arequipa, Ignacio Garaycochea mentioned previously in relation to the *waru waru* experiments and who worked with the PISA team in the mid Eighties, now directs a company dedicated to alpaca fiber, meat and skins production. This company, which represents a model of integrated resource management, is located in Azángaro (Puno) and belongs to the Michell group, specialists in fibers and wool, textiles and clothing for national markets and export. During an interview, Garaycochea emphasized that it was his experience in PISA that made it possible for him to organize interdisciplinary and shared work under flexible management with a holistic and critical approach.

In Puno, Arturo Vásquez, who joined PISA in 1987, is behind a number of organizations answering grassroots demands or requirements from CEDECUM. These are small companies that produce Andean or imported foodstuffs (milling, bakery, leaf concentrates factory, etc.). Thanks to these organizations, credit mechanisms like rotating funds (rural credit trusts) have been created. Training activities oriented to various sectors of the population are also operating; some in the fields of nutrition and organization of

[14] This is the first laboratory of its kind outside Lima which is recognized by the institution which undertakes, among other tasks, the regulation of quality control in Peru: the Instituto Nacional de Defensa de la Competencia y de Protección de la Propiedad Intelectual. (INDECOPI)

women around the "*Vaso de leche*" community milk kitchens and "*Comedores populares*" or community restaurants.

A further key informant at the professional level is Germán Escobar who currently works in RIMISP. During his career he has been in contact with many, and initiatied several, of the projects mentioned in this evaluation. From 1970 he worked in the Cáqueza project in Colombia mentioned as a precursor to the production systems projects in Peru and Bolivia. Later he became an IDRC Program Officer located in Bogota, Colombia, and then joined CATIE in Costa Rica as a researcher. He now works with IICA, in Chile, Honduras and Panama.

Some of Escobar's comments are important for this study. As he sees it, IDRC is recognized as the international sponsor or rescuer of Andean crops and of alpaca husbandry. The Center found a niche in the production systems projects that was not sufficiently exploited. However, because IDRC is not an institution dedicated to supporting development action, rather research, it is not associated with or doesn't carry through with its potential successes. He indicated, however, examples of applied research supported by IDRC which were successful because there was a strong element of action or promotion with a beneficiary population (e.g. "*camanchaca*" water capture systems in Chile). Escobar also noted that the influence of IDRC projects can be seen at the international level.

Another interviewee, Raúl Cañas, currently works with a sophisticated systems group in the Faculty of Agronomy at the Universidad Católica of Chile (PUCC) but participated in the PISA project developing production system models to be validated in the Puno communities. Subsequently, on returning to Chile, he advised several PISA scholarship holders, but none of them, according to the interviewee, were from the Universidad Nacional del Altiplano. His conclusion was that this did not adequately support the development of capability in Puno organizations.

Around 1988, the Federal Republic of Germany, began to finance six M.Sc. scholarships per semester in livestock production for foreign students (i.e., non-Chileans) at Cañas's university. The only countries that did not qualify for the scholarships, besides Chile, were Brazil and Costa Rica because they were the beneficiaries of other programs. Among the professors, Raúl Cañas mentioned Peter Hirsch and Oswaldo Paladines a long time IDRC network coordinator hired in Chile with IDB funding. Among the students, he mentioned Blanca Arce, who also worked in PISA and is currently associated with the IDRC supported MANRECUR initiative in Ecuador. All of the candidates had participated in one or another of the projects mentioned in this report and have continued to be involved in projects with a systems approach. According to the interviewee, the German scholarships would not have been possible without the PUCC prior contact with PISA and, therefore, through this project with IDRC. What drew the Germans to the PUCC Faculty of Agronomy was the international experience of its faculty.

As part of the field surveys to trace and identify footprints left by the early IDRC projects, mostly PISCA and PISA, guided open-ended interviews were conducted with

fifteen professionals who participated in the projects and are currently employed in the universities. An analysis of their responses illustrates the impact of their earlier participation in their work today. The most important effect or influence noted was that of faculty members teaching more appropriate material on technologies that students who will work in the Andean region are likely to encounter. Several references were made to new insights into the Andean reality the respondents acquired while working in the projects and how these insights contributed to modifications in their understanding and approaches to their work during and after that experience up to the present.

Most of the respondents to the questionnaires are using a systems approach in their work: in some cases in the classroom, in others in their continued contact with Andean communities, and still others in research. The systems approach is also applied as an integrating background for research not directly dealing with production, but related to planning, regional development, and anthropological studies.

There were many references (one third of the respondents) to the impact the experiences of these professionals has had in better use of natural resources, especially water and soil in the implementation of soil conservation practices and irrigation systems. Another third of the respondents (with a bit of overlap) also mentioned an impact in the use and enhancement of local genetic diversity and selection of seeds noting improved quality of local animal and crop varieties. Several other comments were made on technological improvements such as the appropriate use of chemical fertilisers, combinations of introduced and traditional techniques, and the establishment of basic crop-storage facilities.

A third of the respondents mentioned results in social aspects at the community level. These included training, strengthening of women's organisations, leadership development and human resource management.

There were also a few mentions (3) made of production diversification (handcrafts, bakery, carpenter shop) and on new activities arising from tourism development, especially handcrafts export.

Most of the respondents mentioned improved standards of living in rural areas. In some cases, they referred to community infrastructure, housing and family equipment. In others, services, mainly in education or training and in environmental education with positive consequences in natural resource management. Several comments were also made on improvements at the social level, including social advocacy, organisation of women.

7. Summary Observations and New Challenges

7.1. Summarizing

Throughout this report we have collated and synthesized a wide range of information and perspectives garnered from many different sources. Each one of these had its own context and dynamic which we have endeavored to integrate into a narrative which describes the ways in which IDRC influence in the Andes has been conceived, operationalized and judged over the years. In the end, if there is one definitive impact or influence, it can be summed up in the mission given the Centre at its creation and emphasized by its first president in the following set of activities: building research skills; expanding opportunities for indigenous researchers; and, contributing to the search for solutions to development problems in the researchers' own societies. All the projects examined and the views gathered from knowledgeable informants confirm that IDRC has made a substantial contribution in all aspects of this challenge.

But what of specific impact and benefits to identifiable groups or communities? This is a much more difficult and challenging task. Had we focused on one or two specific projects and gone into some depth in following the many linkages and pathways such impact entails, no doubt we would have discovered a variety of positive localized relationships. Specific measurement of development results arising from a research project and their attribution to an individual donor agency or development organization, however, is spinning a tenuous web. Impact at the level of a family or community, to say nothing of a whole region, is normally the result of many influences drawn together by the target population within an historical background and ecological, cultural and economic context. IDRC projects, even those purporting to take a systems or holistic approach, only deal with a few such relationships at a time. Applied results depend on the interaction of many actors and influences acting at various levels.

While most of the projects examined had quite specific technical objectives, their overall goal was always stated in development impact terms. Usually there was no indication of the linkages or pathways leading from the specific research outputs to the anticipated impact thus ignoring other essential actors and relationships. These connections were assumed to be implicit and, within IDRC, projects tended to be viewed as independent entities to be evaluated in development impact terms more than on their research findings contributing to development problem solutions. In reality and implementation, however, the projects were defined and evolved as much from the perspective of the researchers as from IDRC demands or direction.

We began by presenting a brief contextual history for the projects IDRC developed and supported. The purpose was to indicate how IDRC was joining in a long term dynamic of social change already being acted out in the Andean milieu and beyond. It also was intended to introduce the range of players active in the region and how they would partner with IDRC. Although the projects were, for the most part, limited to agriculture and focused on technology improvement, they were developed and managed in a way

that permitted flexibility for researchers to relate their work more broadly to needs in context, to identify local actors with whom to collaborate, to define new development challenges, and to collaborate in the analysis and interpretation of major problems. The work did not begin and end with the projects, but IDRC support facilitated greater impetus and scope in already initiated efforts at acquiring knowledge, testing potential solutions and building a much wider range of alliances and collaboration for change in Andean society.

In part, this was due to the initiative IDRC took to partner with the regional universities and organizations like IVITA which had a stake in the environment to be studied. Even though establishing this relationship was more difficult, in the case of Peru, than working with universities or other research organizations based in Lima, in the long run, the experience derived and capability developed has stayed in the region and continues to contribute well beyond the specific objectives of the original projects. This has provided a good payoff for investment in the relatively weaker institutions of the *sierra* even though these institutions have not changed fundamentally in their structure and administration. In Cusco and Puno the inheritance has been two graduate schools which teach and develop the approach and focus on a systems understanding of rural development promoted by IDRC. Other universities in Peru as well as in Bolivia also continue to teach farming systems courses and prepare young professionals from the region, some from the indigenous communities, based on manuals and course materials prepared in the context of the PISA and PISCA projects.

The universities themselves have not been stimulated to become major agents and leaders of change, however. This task has fallen to other actors, especially the NGOs and specialized technical development agencies where alumni of the university based projects have taken on positions of leadership. Working relationships were established with NGOs early in their development because of their applied focus and close association with the target population which facilitated participatory research. As illustrated throughout this report, the projects stimulated partnering relationships between universities, NGOs, local groups and international development agencies. The PISCA project encouraged this type of multilateral collaboration on a local basis well before it became more common through networks and consortia.

That IDRC followed a model of international cooperation different from that of other agencies and country programs was noted by various informants in a positive light. Instead of defining projects based on leadership by Canadian cooperants supported by local staff, management and direction of the projects was left in the hands of nationals supported by frequent interaction with IDRC program staff and occasional specialist consultants. To some degree, this introduced problems with respect to methodology and implementation of specific objectives as reflected in the project histories presented in section 4. On the other hand, it resulted in more direct assimilation of the research process and concerns into the overall process of change mentioned as the framework for this study.

One contrast in the recognition of the IDRC approach was encountered in the PISA project which was funded by CIDA. IDRC initially attempted to administer the project according to its normal collaborative practices and ran into difficulties both with CIDA in terms of accountability and reporting and within INIA where responsibilities were split between various groups without adequate overall authority to guide how project funds were allocated to specific research studies. After a critical review, IDRC changed its project management strategy and introduced a highly qualified research team with a strongly technical team leader in charge of the project. The result was much better analyzed and focused technical results and improved relationships with CIDA because of closer adherence to project specifications, more precise and timely reporting and improved cash flow. This shift came at the expense of reducing producer participation and less collaboration in development activities. In interviews for this study, the IDRC model of research support was frequently mentioned as a positive example of effective collaboration. One comment worth noting however, was that while IDRC strategy was excellent and creative in the relatively small projects it normally supports, on a large multi-million dollar project like PISA, a stronger directive hand is needed to satisfy administrative and accountability requirements[15].

Several themes broached in a number of the projects anticipated developments that appeared in later research agendas and in growing environmental concerns. One was the facilitation of a broader awareness of the importance and potential of Andean products and animals, among them quinoa, alpacas and guinea pigs. Another was the systematic collection, assessment and maintenance of genetic materials in well-organized germplasm banks which later served as the basis for a much greater focus on biodiversity and its importance.

The gender equity theme was only nascent in IDRC at the beginning of the period in which the projects were developed and almost non-existent in the Andean institutional and cultural context. As a result, little reference to efforts in this direction is found in the project documentation. Currently, the Andean context is still predominantly male oriented and managed. But women play a strong role in almost all production and marketing activities and this fact was recognized in many projects with explicit efforts to include women in farmer training courses and in university thesis studies in the pilot communities. As noted in the description of PISA, over half the farmer trainees in the project were women. It was also noted, however, that for cultural reasons few women are involved in the lead professions around which the projects were organized which mitigated against a greater gender balance in research leadership roles in the projects. One can say then that although a basic awareness of this theme was present from the beginning, efforts to change the balance were passive, rather than active, and focused on building capability with no direct initiative to modify the structures determining gender inequality. Nevertheless, a number of women who received scholarships or worked in and were influenced by the projects are currently found in senior leadership and research positions in the Andean context.

[15] Personal communication with Dr. Miguel Holle of CIP/CONDESDAN, former PISA project manager

Overall, the IDRC supported projects focused on specific topics related to valuing Andean products and knowledge with the effect of creating a development systems "school" oriented to research for development in the Andean context. It has left an intellectual heritage with styles of research and work traditions defined through in situ experimentation and, as a consequence, added to the social capital of Peru and Bolivia. That IDRC has actively contributed to this social capital formation is recognized and confirmed by the many researchers who continue to work on topics such as recuperation of traditional technology, germpalsm banks and biodiversity, Andean camelids, Andean roots and tubers, and the socioeconomic and market forces which are irreversibly modifying the Andean context and environment.

7.2. New challenges

Bringing multi-faceted issues together

After the 1992 World Conference on the Environment in Rio, many research and development organizations, IDRC included, turned their focus from agriculture and farming systems to the much broader concern for the environment overall, to ecosystems and concepts of their preservation and sustainability. Instead of the focus on human communities and their objectives of greater productivity and income, research moved to another systems level in which concern for ecosystems, policy and environmental protection studies dominated. Rural communities, agriculture and food production were afforded much less attention except as production activities impacted on environment. If impact was hard to determine at the farm and community level, it is doubly hard to measure in terms of human benefit at the ecosystem and environment level. Is there anything from the experiences of the past projects that can be instructive for IDRC in this broader and even more dynamic research arena?

One useful approach has been to represent sets of key variables and their interactions in dynamic computer based models similar to what was introduced in the PISA project and continues in the context of CONDESAN. While important, this approach still requires grounding in the reality of what goes on in the real life interplay of actors, resources and interests in given localities. We believe that the notion of benchmark areas applied in some of the more recent projects and in the Minga prospectus has an interesting potential. IDRC already has a good background in this approach which was already inherent in the in-situ and on-farm experimentation of the older projects. The benchmark area concept can be applied as a framework for testing and facilitating the systematization of experiences, recording the dynamics of interactions, assessing their replicability, and reinforcing mutual learning just as on-farm research introduced similar functions in more limited confines in the past. IDRC and its partners would do well to continue operationalizing and defining the approach as relevant in current activities such as consensus building between stakeholders in sustainable natural resource use and integration of the inputs of many actors in a variety of functions. Current methodology for the creation and development of these sites requires fine tuning as well as systematization and exchange of information on the experiences.

Addressing the dynamic of change in traditional societies

There is little doubt that traditional societies cannot support their growing populations in the same manner they have in the past. These societies have been far from static as they evolved over time in response to outside influences and have taken on new technologies and practices that they deemed beneficial to their own interests and well-being. The problem is not that they won't or can't adapt to change but rather one of reacting to the threats imposed by the rapidity of the changes. Rural societies often lack the knowledge, experience and means to judge the degree of long term risk implied in adopting changes offered to them through the many channels they now encounter. This scenario is played out in the shifting of power structures and control exercised by various groups in an ever more open market economy.

The IDRC projects we studied were predicated largely on the entrance of peasants and their communities more strongly into a market economy where they could sell an excess resulting from increased productivity. This market entrance and expansion meant raising the image and value of traditional crops in a larger marketplace. In part this has been accomplished but the development of markets involves more than selling additional quantities of the same product. New and expanded markets require different product characteristics and greater homogeneity in product quality. For example, export markets for quinoa demand large white grains and an absence of any black hulled types often found in local markets. Traditional types are of various colours and smaller grains. Producing the types valued in export markets is generally more expensive for the poorest small farmers since they require greater attention and more inputs and may be more risky to produce. It is the relatively better off farmers then who can afford to enter the higher value and expanding market sectors while the poorest with little land and other resources become stuck in a subsistence risk averse mode of low level productivity. A dual purpose production structure exists in the transition period where farmers produce for both subsistence and for the market with the better off selling more of their output and beginning to accumulate some capital to invest in other more remunerative enterprises. The reconstruction of *waru warus* and of hillside terraces are not only ways of expanding production area but also of building up a greater capitalization base. While these are important initiatives, they are long term processes and not likely to satisfy more than a small part of the need for increased income streams.

The changes under way are already taking many people away from the land and their traditional community practices and social structure. Research and development is challenged then to find ways to create alternative employment and income opportunities through things such as rural agroindustry, a wider range of rural and village services, migration to larger district and regional urban centres and the creation of livelihoods under periurban conditions. All of these are part of an ever shifting range of conditions and change impacting on traditional societies and forcing modification of endogenous beliefs and practice in response to the multiple exogenous influences they encounter as illustrated in the diagram presented in section 3.2. In this context, there is a real challenge

to identify and select research topics that have true synergistic potential and respond to the fundamental bottlenecks to a positive change process and don't deal only with the more visible negative symptoms of change.

Keeping the beneficiaries in view

Research and development activities should not lose of sight of potential beneficiaries in the mass of interacting environment and market demand variables which demand attention in current projects. In many peasant communities, inhabitants are locked into a situation of prolonged poverty but in a situation where strong cultural and traditional practices give them a sense of place and value. These groups continue to adopt some changes that appear to augment their capacity to produce adequate food (food security) and, to the extent possible, an increasing surplus for sale in often adverse markets. A major objective for them is to avoid the risk of catastrophic loss. Some IDRC support has touched this issue but the results don't show up as something that has a major impact on a beneficiary population's improvement or well being. Technical results that mitigate the most severe effects of production constraints such as frost, pests or diseases in plants and animals can have a substantial effect even if yields aren't greatly improved. If basic food production risk is reduced, it provides more degrees of freedom for producers to progress in other enterprises and endeavours. These are the problems of the poorest members of the rural societies and the most difficult to address and show obvious impact.

In many agencies, IDRC included, the old themes of food and agriculture seem to have become passé. Is this partly the result of a sense or evidence that past agricultural systems oriented work was not effective and didn't show adequately dramatic impact or influence? Our review of past projects, especially those that exhibit continuity in other projects currently in progress, don't seem to support that impression. As Agriculture per se was losing importance in IDRC, new initiatives appeared led from a Social Sciences perspective under a new more general focus related to environmental issues. The traditional interpretations of production systems were enriched by the inclusion of additional variables that added to the perspective of a complex reality. The new initiatives, in many cases, were built on, or assumed, a knowledge base of variables established by the traditional economics and agricultural sciences approaches in combination with other concerns such as the new emphasis on a global economy, growing concern with threats to the natural environment and on perspectives from the social sciences in general. Nevertheless, addressing issues at levels beyond the immediate interests of the poorest rural community members can have negative impacts if awareness of linkages and cause-effect chains are not explicitly kept in mind.

The congresses and conferences on Andean production systems organized over the years, many with IDRC support, point in the direction of a growing integration of the knowledge contributed by the agricultural and social sciences even though the former still dominate in the Andean context. For those who work on these themes in the field, in contact with rural people however, the concerns for agriculture and food are not a thing of the past and still represent important initiatives in creating opportunities for improvement in the rural realities they address each day.

The above observation is not to suggest that IDRC should return to past priorities in its programming structure, only that they not be forgotten in a search for new "solutions".The call here is for an analytically strategic approach. As an example from current programming, conflict elements in access to and use of natural resources (especially land and water), and the mechanisms for conflict resolution, are being addressed within the experiences of several consortia which have arisen out of projects supported by IDRC. Of particular interest are the "round tables" or consensus groups being developed in CONDESAN benchmark sites such as those of Cajamarca (Peru) and of El Carchi (Ecuador). The round tables are not only a manifestation of the positive character of alliances (the focus on working together), but also of their conflicting aspects where consensus is necessary to reach agreement on working together. These initiatives should be further developed in the context of testing and introducing methods which facilitate smoother and more equitable outcomes in the broader change process. Within this context, not only will actors learn how to resolve conflicts and common problems with which they are confronted, but these experiences will also serve as learning opportunities on how to carry out the co-operative work required to solve shared problems and differentiated interests, clearly with a broad range of beneficiaries in mind.

Institutionalization

An objective of many of the projects analyzed was the institutionalization of the research for development approach IDRC was promoting. This was assumed to be adoption and application of the methods encouraged in individual projects into the structure of recipient organizations. As we have seen, in most cases this did not happen in the manner anticipated, especially in large government bureaucracies and university structures dominated by traditional interests and control relationships. On the other hand, the consolidation of interactions in consortia, in alliances and in other co-ordination arrangements where assimilation did happen individuals carried their project gained experiences to new environments in other organizations. This raises questions about the nature and process of institutionalization of change. The process of institutionalization involves a consolidation of promoted or encouraged changes, in a stable arrangement, within what are called institutions. In this sense, institutionalization goes beyond simple consolidation of actions in a single organization and any related changes.

The notion of "organization" refers to human groupings exhibiting: well defined objectives; a structure; power relationships; influence; responsibilities; internal communications networks; and, participation in a variety of external networks. The members of any organization can be replaced but the organization continues to exist. An organization, in this sense, has a life of its own. It is born or created, grows, develops and reaches maturity and finally declines and dies.

The notion of "institution",on the other hand, refers to more permanent arrangements that have a durable regulatory function that can be analyzed as an organic whole reaching beyond single organizations. Although institutions are durable arrangements, they still have a life cycle: that is, they are born, they are developed, they evolve and reach

maturity and finally fade away or die. But this cycle is more stable and extends over much longer periods of time until replaced by new arrangements consolidated as new institutions adapted to new conditions.

Institutionalization is a process by which social models are organized in a durable and similar manner. We have referred to the necessity of duration of changes and the demands that time imposes to prove that durability. Another qualitative aspect of this durability is that in all organizations the operational models applied (for example, in development, in research, in structure, in interactions, in power relationships, etc.) must also be prolonged over time. This aspect is reinforced if the models have been relatively successful because it is always better or easier to continue applying something that has gone relatively well than to begin again from another perspective.

In addition, the prolongation of operational models over time must be exercised almost without the organization being consciously aware of it happening in an expressed or conscious will to produce or reproduce them. As an example, this is what we observed in the partnering relationships among organizations involved in the PISCA related projects. The concept had a rather limited reach at the beginning of the study period, confined to the relationships between IDRC, IICA and the universities, generally considered individually. As the projects and experiences evolved, they began to create networks, conceiving the group of universities as a network with a certain specialization among components. Interactions with government agencies appeared and others with NGOs, with producer organizations, and with the development organizations of other countries. Then came the consortium idea and with it an evolution of the notions related to NGOs, to community organizations and to others, seen now as equal members or partners in the consortium. What has been consolidated or institutionalized, are the consensus and agreement on efforts and approaches to development or research-development activities such that they have become internalized in the transactions of the partnership among various organizations.

To take the argument to a project level, in any project there are numerous interests in play and each group tries to arrange for the project to serve its own interests. Sometimes, the sense of alliance is fragile and this in general results in opportunism or failure, but in other cases the alliance forms because each actor sees that his/her own interests can be served if those of the other partners are also realized, a kind of win win situation. The vision of IDRC, at least as perceived from the Andean projects reviewed, has been on one side an alliance and on the other, one of opportunity beyond that of opportunism. By supporting the projects, IDRC was anticipating that the proposed changes would be adopted and converted into stable models including the introduction of ideas and research methods developed and tested in other places. This is an example of "institutionalization" of these practices through projects in the Andean context.

However, the role of projects in institutionalization is limited. It is possible that some changes occur as a result of project operations and success but that nothing becomes institutionalized in a permanent sense (understood as relatively permanent) in the life of the recipient organization or of other participants. The opposite is also possible. A project

can appear to be relatively unsuccessful in terms of expected outputs, but the attitudes, behaviours, and practices the project attempted to influence remain incorporated in relatively permanent form in the life of the community or the partner organizations thus having been, in this sense, institutionalized.

From another angle, institutionalization requires organizational preparation and readiness. This involves bringing together conditions which permit permanent arrangements to be installed within the desired framework and to assure protection and development of the new introductions. In the framework of this evaluation study, we encountered such conditions in that a large network of NGOs was forming in Peru and Bolivia at the same time as the IDRC supported projects were being developed. The NGOs were not a condition or part of the IDRC support that only sought alliances with the universities and with public agricultural research bodies. But today, the NGOs are practically *sine qua non* for the realization of a wide variety of projects. Along the way, this new set of actors, having appeared in force, was able to provide the organizational preparation required to assure continuity for the experience and output of the projects. Today, the NGOs are to an important extent the guardians of the values which were introduced in the first projects that did not include alliances with NGOs. With the passing of time, it was through the NGOs that the values and practices nurtured in the projects were converted into institutionalized values and the results of the projects were applied.

This process poses new challenges for IDRC and its partners. New perceptions and expanded concepts are required to move the models of social and productive interchange, already institutionalized at a first level of requirements, towards greater levels of maturity. Today's challenge is to reach for new degrees of interdependence without dependence, for new levels of internal democracy and for greater efficiency, productivity and equity in the utilization and protection of a vulnerable natural resource base.

Annexes

Annex 1: Acronyms

Acronym	Full name	See also
ABTEMA	Asociación Boliviana de Teledetección para el Medio Ambiente (Bolivian Association of Remote Sensing for the Environment)	
ACDI	Agence canadienne de développement international	CIDA
ACDI	Agencia Canadiense de Desarrollo Internacional	CIDA
AFNS	Agriculture, Food and Nutrition Sciences Division	
APRA	Ac[ción Popular Revolucionaria Americana (American People's Revolutionary Action)]	
BID	Banco Interamericano de Desarrollo(InterAmerican Development Bank)	IADB
BIO	Biodiversity Conservation Program Initiative	
CARE	Cooperativa Americana de Remesa al Exterior	
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza (Tropical Agriculture Research and Training Centre)	
CCC	Centro de Capacitación Campesina (Peasant Training Centre)	
CEDAP	Centro de Estudios y de Desarrollo Agrario del Peru (Centre for Studies and Agrarian Development of Peru)	
CEDECUM	Centro Privado para el Desarrollo del Campesinado y del Poblador Urbano Marginal (Private Development Centre for Peasants and Marginal Urban Dwellers)	
CEDEP Ayllu	Centro de Desarrollo de los Pueblos – Ayllu (Peoples' Development Centre – *Ayllu*)	
CEPRODEP	Centro de Promoción y Desarrollo Poblacional (Inhabitants' Promotion and Development Centre)	
CGIAR	Consultative Group on International Agriculture Research	
CIAT	Centro Internacional de Agricultura Tropical (International Center for Tropical Agriculture)	
CIDA	Canadian International Development Agency	ACDI
CIDRA	Comité Interinstitucional de Desarrollo Rural de Ayacucho (Interinstitutional Rural Development Committee of Ayacucho)	
CIED	Centro de Investigación Educación y Desarrollo (Education and Development Research Centre)	
CIID	Centro Internacional de Investigaciones para el Desarrollo	IDRC CRDI
CIP	Centro Internacional de la Papa (International Potato Center)	
CIRF	Consejo Internacional de Recursos Fitogenéticos	IBPGR

Acronym	Full name	See also
CIRNMA	Centro de Investigación en Recursos Naturales y Medio Ambiente (Center for Research on Natural Resources and Environment)	
CISA	Coordinadora Institucional del Sector Alpaquero (Alpaca Production Sector Institutional Coordinator)	
COINCIDE	Coordinación Intercentros de Investigación, Desarrollo y Educación (Intercenter Coordination for Research, Development and Education)	
CONDESAN	Consorcio para el Desarrollo Sostenible de la Ecorregión Andina (Consortium for the Sustainable Development of the Andean Ecoregion)	
COPASA	Food security project in Colca Valley (Arequipa) supported by the German Agency GTZ	
CORDEPAZ	Corporación de Desarrollo de La Paz (La Paz Development Corporation)	
CORDEPO	Corporación Departamental de Desarrollo de Potosí (Departmental Development Corporation of Potosí)	
COSUDE	Agencia Suiza para el Desarrollo y la Cooperación (Swiss Agency for Development and Cooperation), also known in Spanish as Cooperación Suiza para el Desarrollo	
CRDI	Centre de recherches pour le développement international;	IDRC CIID
CSR	Cropping systems research	
DESCO	Centro de Estudios y Promoción del Desarrollo (Development Promotion and Studies Centre)	
ENR	Environment and Natural Resources Division	
EPG	Escuela de Post-Grado (Post Graduate School)	
EU	Evaluation Unit	
FAO	United Nations Food and Agriculture Organization	
FIDA	Fondo Internacional de Desarrollo Agrícola (International Fund for Agricultural Development)	IFAD
FSR	Farming systems research	
GNP	Gross national product	
GTZ	Deutsche Gesselschaft für Technische Zusamenarbeit GmbH (German Corporation for Technical Cooperation)	
IADB	Inter-American Development Bank	BID
IARC	International Agriculture Research Centre	
IBPGR	International Bureau of Plant Genetic Resources, later, International Plant Genetic Resources Institute	IPGRI

Acronym	Full name	See also
IBTA	Instituto Boliviano de Tecnología Agropecuaria (Bolivian Institute for Agriculture and Livestock Technology)	
ICA	Instituto Colombiano Agropecuario (Colombian Agricultural Institute)	
ICTA	Instituto de Ciencia y Tecnología Agrícola, Guatemala (Agricultural Science and Technology Institute, Guatemala)	
IDEMA	Instituto de Defensa del Medio Ambiente (Environmental Protection Institute)	
IDRC	International Development Research Centre	CRDI CIID
IER-Arguedas	Instituto de Estudios Regionales José María Arguedas (José María Arguedas Regional Studies Institute)	
IICA	Instituto Interamericano de Cooperación para la Agricultura (Inter-American Institute for Cooperation on Agriculture), formerly Instituto Interamericano de Ciencias Agrícolas (Inter-American Institute for Agriculture Sciences)	
IFAD	International Fund for Agricultural Development	FIDA
INIA	Instituto Nacional de Investigación Agraria (National Institute of Agrarian Research), formerly INIAAA and INIPA	INIAA INIPA
INIAA	Instituto Nacional de Investigación Agropecuaria y Agroindustrial (National Institute of Agrarian, Livestock and Agroindustrial Research), formerly INIPA and lately INIA	INIPA INIA
INIPA	Instituto Nacional de Investigación y Promoción Agropecuaria (National Institute of Agriculture and Livestock Research and Extension), later INIAA and INIA	INIAA INIA
IPAZ	Instituto de Investigación y Promoción del Desarrollo y Paz (Development and Peace Research and Promotion Institute)	
IPGRI	International Plant Genetic Resources Institute, formerly IBPGR	IBPGR
IRD	Institut de recherche pour le développement, formerly Office de la recherche scientifique et technique outre-mer and later known as Institut français de recherche scientifique pour le développement en coopération	ORSTOM

Acronym	Full name	See also
IRRI	International Rice Research Institute	
IVITA	Instituto Veterinario de Investigaciones Tropicales y de Altura (Veterinary Institute for Tropical and Highlands Research)	
LACRO	Regional Office for Latin America and the Caribbean, formerly Regional Office for Latin America	LARO
LARO	Regional Office for Latin America, now LACRO, Regional Office for Latin America and the Caribbean	LACRO
LISA	Low Input Sustainable Agriculture Program Initiative	
MACA	Ministerio de Asuntos Campesinos y Agropecuarios (Department of Peasant, Agriculture and Livestock Affairs, Bolivia)	
MANRECUR	Proyecto de Manejo de Recursos Naturales (Natural Resources Management Project)	
MARENASS	Manejo de Recursos Naturales en Sierra y Selva (Natural Resource Management in the *Sierra* and Rainforest)	
MERCOSUR	Mercado Común del Sur (Southern Common Market), includes Argentina, Brazil, Paraguay and Uruguay as members, and Bolivia and Chile as associates	
MERISS	Mejoramiento del Riego en Sierra y Selva (Irrigation Improvement in the *Sierra* and Rainforest)	
MNR	Movimiento Nacionalista Revolucionario (Nationalist Revolutionary Movement)	
NARS	National Agricultural Research Systems	
NGO	Nongovernment organisation	
NRM	Natural resources management	
NUFFIC	Nederlandse organisatie voor internationale samenwerking in het hoger onderwijs (Netherlands Organisation for Cooperation in Higher Education)	
ONERN	Oficina Nacional de Evaluación de Recursos Naturales (National Bureau of Natural Resources Evaluation)	
ORSTOM	Office de la recherche scientifique et technique outre-mer. Later known as Institut français de recherche scientifique pour le développement en coopération and now Institut de recherche pour le développement (IRD)	IRD
PACE	Proyecto Arqueológico de los Campos Elevados (Raised Fields Archeological Project)	

Acronym	Full name	See also
PCR	Project completion report	
PCSR	Production to Consumption Systems Research	
PELT	Proyecto Especial Lago Titicaca (Lake Tititcaca Special Project)	
PI	Programme Initiative	
PICA	Programa de Investigación en Cultivos Andinos (Andean Crops Research Program)	
PICASA	Proyecto de Investigación de Cultivos Andinos y Sistemas Agropecuarios (Andean Crops/Livestock Systems – Peru Project)	
PISA	Proyecto de Investigación de los Sistemas Agropecuarios Andinos (Andean Farming Systems Project)	
PISCA	Proyecto de Investigación de Sistemas de Cultivos Andinos (Andean Crops-Peru Project)	
PIWA	Proyecto Interinstitucional de Waru-waru (*Waru-waru* Interinstitutional Project)	
PNSA	Programa Nacional de Sistemas Andinas (National Andean Systems Program)	
PNSAPA	Programa Nacional de Sistemas Andinos de Producción Agropecuaria (National Andean Crop and Livestock Production Systems Program)	
PPPO	Participatory program planning by objectives	
PRODASA	Proyecto de Desarrollo Agropecuario Sostenible en el Altiplano (Sustainable Highland Agriculture-Peru Project)	
PROINPA	Fundación de Promoción e Investigación de Productos Andinos (Andean Products Promotion and Research Foundation)	
PRONAMACHS	Programa Nacional de Manejo de Cuencas Hidrográficas y Conservación de Suelos (Watersheds Management and Soil Conservation National Program)	
PUCC	Pontificia Universidad Católica de Chile, Santiago	
PUCP	Pontificia Universidad Católica del Perú, Lima	
R&D	Research and development	
RAAA	Red de Aplicación de Alternativas al uso de Agroquímicos (Application of Alternatives to Agrochemical Use Network)	
RAE	Red de Agricultura Ecológica (Ecological Agriculture Network)	
REPAAN	Red de Pastos Andinos (Andean Pastures Network)	
RIMISP	Red Internacional de Metodología de Investigación de Sistemas de Producción (International Network for Production Systems Research)	

Acronym	Full name	See also
RISPAL	Red Internacional de Sistemas de Producción Animal (International Animal Production Systems Network	
RTA	Programa de Raíces y Tubérculos Andinos (Andean Roots and Tubers Biodiversity Program)	
SAIS	Sociedad Agrícola de Interés Social (Agriculture Production Cooperative)	
SIBTA	Sistema Boliviano de Tecnología Agropecuaria (Bolivian System of Agricultural and Livestock Technology)	
SINAMOS	Sistema Nacional de Apoyo a la Movilización Social (National Social Mobilisation Support System)	
TAC	Technical Advisory Committee	
TADEPA	Taller de Promoción Andina (Andean Promotion Workshop)	
TECO	Threatened Ecosystems Program Initiative	
UATF	Universidad Autónoma Tomás Frías, Potosí, Bolivia	
UCSA	Universidad Católica Santa María, Arequipa, Peru	
UMSA	Universidad Mayor de San Andrés, La Paz, Bolivia	
UNA	Universidad Nacional del Altiplano, Puno, Peru	
UNALM	Universidad Nacional Agraria de La Molina, Lima, Peru	
UNDP	United Nations Development Program	
UNMSM	Universidad Nacional Mayor de San Marcos, Lima, Peru	
UNSA	Universidad Nacional de San Agustín, Arequipa, Peru	
UNSAAC	Universidad Nacional San Antonio Abad, Cusco, Peru	
UNSCH	Universidad Nacional San Cristóbal de Huamanga, Ayacucho, Peru	
UNTA	Universidad Nacional Técnica del Altiplano, Puno, Peru	
USAID	United States Agency for International Development	

Annex 2: List of Projects

Table 7: Summary of Projects Objectives

Year	Project	General Objectives & Key Activities
1979 78-0133	Andean Crops (Peru) I PISCA Recipient: IICA Universities in Ayacucho, Cusco and Puno	1. Raise level of living through increased production and productivity of traditional agricultural systems; 2. Fortify FS capacity of 3 universities to undertake: a) training b) research 3. Key actions: ecological & socioeconomic characteristics; small Andean prod. systems; design, test, evaluate alternative technologies; increase production & productivity; efficient technology introduction system; improved training for students from Andean region; training & information for professors & students.
1982 82-0091	Andean Crops (Peru) II PISCA Recipient: IICA Universities in Cusco, Puno and Arequipa	1. Promote improved living conditions by R&D activities in crops, animals, forestry & socioeconomic studies. 2. Key actions: Complete ecological, technical & socioeconomic analysis; generate technology at community level; publish & distribute information.
1986 86-0124	Andean Crops/Livestock Systems (Peru) III - PICASA Universities in Arequipa and Ayacucho, INIPA-CIPAVII	1. Improve agricultural production methods. 2. Increase capability to conduct R&D activities in the Andean small farmer environment. 3. Key actions: complete site characterization; more detail on animal production systems; improve agric. Production systems; train community members in improved methods; train students in community level research; conservation & evaluation of local root crop germplasm.
1985 84-0193	Andean Farming Systems (Peru) – PISA (CIDA/IDRC) Recipient: INIPA	1. Improve production and productivity of crops and animals (Puno region); 2. Increase the well-being of small farmers. 3. Key actions: expand agric. research & extension programs in Puno; update main FS studies; develop training for farmers & staff; farmer & community oriented extension services.

Year	Project	General Objectives & Key Activities
1993 92-8753	Sustainable Highland Agriculture (Peru) PRODASA Recipient: CIP/ CIRNMA	1. Consolidate & execute a sustainable agricultural research & rural development program in Puno communities. 2. Key actions: gather quantitative information on relevant problems; generate technological alternatives: prepare projects on sustainable agric.; train & collaborate; professionals, technicians, farmers, local government reps; disseminate technical information.
1992 92-8753	Sustainable Andean Development (CIP) CONDESAN I Recipient: CIP	1. Organize a collaborative R&D programme to promote sustainable development in Andean Eco-region based on appropriate NRM. 2. Key actions: holistic studies; ecosystems; identify key constraints & opportunities; collaborative R&D; information exchange; methodologies; policies; encourage competitiveness, creativity & efficiency.
1994 94-0014	Sustainable Andean Development Consortium - CONDESAN II Recipient: CIP	1. Support a regional programme for sustainable development of the Andean ecoregion. 2. Key actions: Land & water management; design & validate technologies & policies; comparative advantage, value-added options; collaborative work; biodiversity; training; public awareness; poverty alleviation; food security; small entrepreneurs.
1997 97-8754	Sustainable Andean Development Consortium CONDESAN III Recipient: CIP	1. Support continued development of CONDESAN. 2. Key actions: support the co-ordinating unit and strengthen partnerships; workshops, MSc programme development & distance learning; facilitate community NRM decision-making.
1997 96-8761	Binational Resource Management (Peru/Bolivia) CIP/CIRNMA	1. Contribute to the sustainable socioeconomic development of the Altiplano region, based on, 2. Existing & potential agricultural production, transformation and marketing systems. 3. Key actions: design & test models; technology & policy options; transformation of agric. products; production to consumption systems; comparative market advantage; disseminate info & results.
1976 76-0078	Quinoa (Bolivia) I Recipient: IBTA	1. Increase quinoa production, to reduce food imports. 2. Improve nutritional status of the altiplano population of Bolivia. 3. Increase incomes & employment levels of rural people in the Bolivian altiplano. 4. Key actions: develop quinoa varieties; screen germplasm; collect introductions; establish germplasm bank; economic production packages & components; train and instruct; improved agric. techniques.

Year	Project	General Objectives & Key Activities
1980 80-0015	Quinoa (Bolivia) II Recipient: IBTA	1. Improve, multiply and distribute improved quinoa materials. 2. Advance knowledge of quinoa genetics. 3. Provide learning opportunities for technical personnel, students and quinoa producers.
1985 85-0012	Quinoa (Bolivia) III Recipient: IBTA	1. Develop improved quinoa-based production systems for small farmers. 2. Key activities: select, improve, evaluate, multiply, distribute superior quinoa varieties; improve quinoa farming systems; disseminate improved practices.
1991 91-0005	Highland Farming Systems (Bolivia) Recipient: IBTA	1. Improve sustainable production and productivity of crops and animals in 5 peasant communities. 2. Strengthen FSR in IBTA & other related institutions. 3. Key actions: characterize & assess farming systems; identify constraints; evaluate technological alternatives; on farm; train technical staff in FSR; involve farmers in research process; extend results.
1984 83-0209	Andean Crop Processing (Peru) Recipient: IICA Universities in Cusco and Puno	1. Develop improved techniques and systems for harvesting, preservation, and processing of native grains & tubers in Andean communities. 2. Key actions: survey & document post harvest practices; identify main problems; marketing problems & opportunities; select priorities; equipment & procedures; establish modules; participation; provide experience; applied research; related curricula.
1988 87-0334	Women & Andean Postharvest Technology (Peru) Recipient: UNA, Puno	1. Assess changes brought about by the introduction of improved postharvest technologies in 2 Andean communities. 2. Key actions: monitor use of introduced facilities; document women's activities in communities; assess nutritional composition of family diets; assess impact of technologies on women's activities & community nutrition.
1988 88-0023	Andean Food Processing (Peru) Recipient: C.I.E.D. for Universities in Puno, Cusco, & Arequipa.	1. Develop improved techniques for harvesting, preservation, processing and marketing of crop and animal products in Southern Peru. 2. Key actions: characterize PH systems; identify market characteristics for Andean products; test improved PH techniques; establish small service enterprises; train researchers.

Year	Project	General Objectives & Key Activities
1986 85-0182	Guinea Pig Production Systems (Peru) Recipient: INIPA	1. Develop improved guinea pig production practices for households & small enterprises. 2. Key actions: characterize GP raising practices; identify limiting factors; physiological, health, breeding, management, reproduction, mortality; bio-economically improved practices; strengthen links between INIPA & local universities; rationalize use of available resources for GP research; training.
1989 89-0115	Guinea Pig Production Systems (Peru) II Recipient: INIAA	1. Develop appropriate technologies for improvement of prevalent GP production systems. 2. Key actions: complete bio-economic characterization; interactions in farming systems; nutritional factors affecting production; genetic selection & evaluation; improved on-farm technologies; transfer knowledge.
1993 93-0028	Household Small Animal Production Systems (Peru) Recipient: CE&DAP CONDESAN link	1. Generate & promote appropriate technology for family production systems in rural & urban periphery areas - food security. 2. Key actions: increase GP production in family production systems; social studies of activities in family GP production systems; interaction with other household activities; training of women, technical personnel, children, leaders & extension agents; analyse tech. transfer methods; disseminate tech info.
1980 80-0109	South American Camelids (Peru) I Recipient: IVITA	1. Increase the income and nutrition of High Andean peasants by improving their alpaca production. 2. Augment the area on high altitude rangelands through better management. 3. Key actions: improve pasture management techniques and feeding systems; develop disease control schemes; increase alpaca reproductive efficiency; disseminate research results; and train Peruvian scientists in alpaca production research.
1986 85-0253	South American Camelids (Peru) II Recipient: IVITA	1. Develop improved alpaca production systems for small farms in Peruvian highlands. 2. Key actions: complete analysis of prod. Systems; generate technological component alternatives; evaluate alternatives at station & on farm; establish technology transfer mechanisms.
1989 89-0040	South American Camelids (Peru) III Recipient: IVITA	1. Develop improved alpaca production systems for small farms in Peruvian highlands. 2. Key actions: complete production system analysis; evaluate technological alternatives; promote improved technologies; train scientists; alpaca production systems.
1982 82-0165	South American Camelids Information Service Recipients: IVITA in Peru and INFOL in Bolivia	1. Establish a specialized information analysis service on South American camelids. 2. Key actions: collect, process and disseminate documentation on alpacas, llamas & vicuñas; offer documentation services to institutions and individuals; promote knowledge in all technical aspects of South American camelids aimed at increasing their production and utilization.

Year	Project	General Objectives & Key Activities
1976 76-0144	Pasture Management (Peru) I Recipient: Universidad Nacional Agraria La Molina (UNALM)	1. Introduce new grass and legume forage species and improve native pasture management techniques. 2. Key actions: on-site research at a SAIS or co-operative agricultural enterprise; devise micro-nutrient supplement programs for sheep and cattle; devise systems to provide dry period feed; train local personnel in pasture management and research.
1980 80-0058	Pasture Management (Peru) II Recipient: UNALM	1. Increase livestock & meat production in high Andean region of Peru. 2. Key actions: improve native pasture management techniques; evaluate new forage species; devise supplementation feeding programs; feed production during dry periods; train local personnel in pasture management; utilization of cultivated forages in the high Andes.
1985 85-0122	Agroeconomics in Farming systems (Peru) Recipient: INIPA	1. Develop a working methodology for INIPA agroeconomic and agronomic research teams to conduct on-farm FSR. 2. Key actions: characterize and classify farms as production systems; evaluate agroeconomic modifications to current farming systems; test modifications with farmers; collect and monitor information from selected farms and evaluate adoption of tested alternatives.
1987 87-0182	Dynamic Analysis of Farm Data (Peru) Recipient: Centro de Estudios y de Desarrollo Agrario del Peru (CE&DAP)	1. Generate and test procedures to design, collect and analyze small farm records of use in applied research. 2. Key actions: test analytical tools for dynamic analysis of farm activities; establish minimum collection frequency needed; apply and document selected dynamic analytical methods; introduce selected methodological procedures to RISPAL and other research projects.
1990 90-0137	Decision-Making Analysis (Peru) Recipient: CE&DAP	1. Understand small farmer decision-making processes and test methodological procedures for integrating these into developing and introducing technological alternatives. 2. Key actions: elaborate a conceptual framework and formulate models; adapt operations research methods; validate the framework and methods with small farm data; transfer results to the scientific community and agricultural research institutions.

Year	Project	General Objectives & Key Activities
1986 86-0296	Rural Credit (Peru) Recipient: Centro Regional de Estudios Socio-Economicos (CRESE)	1. Propose an integrated credit programme for six peasant communities. 2 Key actions: understand the beliefs and attitudes of peasant men and women regarding credit; observe behaviour patterns and risk and design better adapted credit schemes; assess the viability of alternative schemes; assess improved potato storage technology as a means of reducing risk; study the role of outside credit in potato marketing; assess if access to credit is a major impediment to change; survey credit experiences in other countries.
1987 87-0165	Community Organizations (Peru) Recipient: Univ. Cusco & Instituto de Investigacion UNSAAC-NUFFIC,	1. Undertake a comparative study of Peasant Communities and Agricultural Production Co-operatives; 2. Contribute to more effective rural development policies by proposing alternative models for production oriented projects; 3. Prepare a general plan as the basis for a rural micro-regional development proposal. 4. Key Actions: describe and measure differences in economic and social effectiveness in community organization; explore factors associated with differences in success of social and community groups; compare adaptation processes of peasants; design strategies and organizational and management models.
1996 50215	Policy Interventions in the High Andes Recipient: CIP/CONDESAN	1. Develop an approach to alleviate poverty and reduce land degradation in a socially viable and cost effective way through prototype policy interventions. 2. Key actions: develop scenarios; establish an approach to identify concentrations of poverty and resource degradation; design policy interventions incorporating local perceptions; assess and implement selected policies; evaluate the impact of the policies; disseminate the methods and results and do training; do ecoregional analysis of project policy experiences.

Annex 3: Methodology

Many people contributed to the gathering of information and its analysis. The study was designed and organized by Ed Weber (consultant and former IDRC program officer) and by Martín Mujica, IDRC sabbaticant and professor of Sociology at the Université de Moncton. In Peru and Bolivia, Etienne Durt carried out the field work with input from Prof. Mujica. They contacted many past participants in the projects in research institutions as well as in communities where on-farm and participatory research took place. Mr. Durt was guided to important materials and introduced to many of the former actors by key informant Dr. Mario Tapia, a central actor in many of the main project activities, and author of several key information sources. The study was initiated in November, 1998, and continued until August, 1999, in Canada, Peru and Bolivia.

a. Preliminary research

Within the context of preparing the original evaluation research proposal, a set of over thirty IDRC supported projects in the High Andes of southern Peru and in Bolivia were selected from a list of project abstracts provided by the IDRC library. Selection was made on the basis of substantial orientation to agriculture and food systems and natural resource management in the focus area. Project appraisals, abstracts, prior phase results and project objectives were extracted from project summary documents in the IDRC archives and current files. Where available, copies of project completion reports (PCRs) were collected and reviewed. Other documentation included evaluation reports, final project reports and, in some cases, relevant correspondence on specific issues. Copies of the project summary material were provided to the field researchers in Lima and the content and focus discussed during planning sessions with them. A wide range of published material was also assembled and reviewed in the course of preparing the report.

For historical background, the authors drew on their knowledge of the Latin American reality, as well as of relevant projects, organisations and individuals. This perspective is supported by reference to a range of published material which is listed in the bibliography. Background information on the evolution of IDRC involvement in Andean natural resource based production systems came from a mix of IDRC file and published materials and personal experience. Several former IDRC programme officers in the region were consulted for their views. IDRC Program of Work and Budget documents for the years between 1975 and 1988 were reviewed to derive a sense of the background philosophy and overall objectives which provided the context for project development during the period in which many of the projects were defined and funded.

b. Field research

Fieldwork involved a series of five visits for information collection in the various locations where work was carried out:

1. An initial reconnaissance trip to establish appropriate contacts and interview arrangements in the various Southern Andes Universities in Peru;
2. A trip to Bolivia to visit public institutions linked to the Instituto Boliviano de Tecnología Agropecuaria (IBTA) and the Fundación de Promoción e Investigación en Productos Andinos (PROINPA), in La Paz and Cochabamba;
3. Visits to Cusco and Arequipa to conduct focus group interviews with university researchers in communities who had participated in project research activities;
4. A fourth journey focused on institutional interviews, training of local interviewers and coordination of activities in each location;
5. Finally, a tour of visits to collect materials, debrief collaborators and complete information gaps.

Detailed itineraries of these various visits are found in Annex 4.

In the field, the main purpose was to uncover traces and influences of work carried out over a period of up to twenty years in the past. To accomplish this, in accordance with the proposal, the following sources of information were explored:

b.1. Document analysis

Course curricula, and academic prospectuses for first degree and Masters level programs in agricultural sciences were acquired and analyzed for the Universities in the southern region.

b.2. Institutional interviews

Interviews were undertaken with academic officials and individuals in each university who had been associated with the projects carried out in Ayacucho, Cusco, Puno, Arequipa and Lima for Peru. For Bolivia, similar interviews took place in La Paz and Cochabamaba. The persons sought were found in a range of employment whether in the universities, the public agricultural sector, or in the private sector and NGOs. These interviews were based on a general protocol elaborated for the purpose earlier. The interviews and questions were of an open non-directive genre. A total of 15 interviews were conducted.

b.3. Focus groups

In each regional center and in Lima, focus groups were organized comprised of individuals who were main actors in the core projects and subsequent related activities and projects. The purpose was to reconstruct a vision of the experiences of these participants in the projects whether from the point of view of the biological sciences (agronomy, biology, livestock and veterinary sciences, food sciences, etc.) or human sciences (anthropology, economics, health, sociology, etc.) from various angles in order to document and analyze their accumulated experiences. The discussions were focused toward determining the extent to which the participants captured elements of the projects

and their objectives and how the lessons learned influence the approach they take in their work today. In every case, attempts were made to achieve a good balance in the composition of the groups between representation of the various themes of interest and the availability of potential participants.

In Cusco, two focus groups were organized:

The first, held at the university, focused on the articulation between research and teaching guided by the following questions:

- Where did we come from? Where are we? Where are we going?
- Who are the actors and in what institutional spaces?
- What has been accomplished and what are the new demands?
- What are the current perspectives on reconciliation of views, innovation, and research paradigms?
- Views on inter-disciplinary, inter-sectorial, and inter-cultural work?

The second group involved participation of NGO representatives and dealt with the theme of relationships between agricultural promotion and production according to questions of:

- Who are the actors and in what institutional spaces?
- Adjustment, interpolation of technical proposals and peasant requests?
- Articulation between production, processing/transformation and commercialization?
- Impact on employment, income and value-added, rural or urban?
- New roles for local government, rural enterprises and technical consultation?
- New approaches and issues: watershed management, environment, gender, etc.

In Arequipa, the focus group discussed themes related to post harvest and market issues along the following lines:

- Value-added in rural areas through storage, processing and commercialization?
- Agro-ecological, socio-economic and politico-cultural impacts?
- Concrete perspectives of impact on employment, income and environment?
- Actual political, social and economic conditions?

In Puno, the focus group dealt with crop-livestock and agroindustry-agribusiness articulation in terms of the following:

- Successful applications and experimental proposals?
- Sustainability and replicability?
- Influence circles: a) community, local and/or regional governments; b) university and/of technological institutes; 3) administration and/or NGOs?
- Perspectives on genetic resources, technology, credit and training?

The focus group discussion in Ayacucho was oriented toward relations between university, community and regional development according to sub-themes of:

- The role of the university in research, teaching and social influence?
- The current situation and expectations of peasant communities?
- The role of: a) the public, regional and agrarian sectors; b) private enterprise; c) the NGOs?
- Circles of mutual influence, competitive or complementary?
- Regional results and perspectives?

In Lima, the group discussed relationships between research and development related to the following:

- Dynamics between the two poles?
- Technological changes generated and concrete results?
- Participation at inter-personal, inter-communal and inter-institutional levels?
- Sustainability of the pilot-testing and regional replicability?

Comments and suggestions were entertained at the end of each session. Most of the key informants who held important responsibilities in the projects participated in the focus groups.

b.4. Personal interviews

In each of the departmental capitals in which work was carried out, a professor was sought as local contact and support for the young professionals who administered a total of 18 questionnaires to a non-probabilistic sample of graduates from the faculties of agronomy, and animal husbandry. These arrangements were made in order to document the impact of the project focus on production systems both in the graduates academic preparation and in their subsequent professional careers.

This activity was preceded by elaboration of a group of questions compiled in an interview guide for use by the interviewers. All personal interviews were of an open non-directive type.

Interviews were also conducted with key informants not available in the project areas but were contacted in other localities where they worked such as Lima and Santiago de Chile.

b.5. Visits to peasant communities

Finally, field visits were made to pilot communities formerly associated with some of the projects in order to observe the sustainability and continuity of the proposals. At the same time, note was taken of the replicability in neighbouring communities or in the micro-regional environment. In these visits, direct observation techniques were utilized along with informal, open ended question interviews with local officials and neighbours.

Annex 4: Field Visits

The main field activities by the evaluators and the local consultant were conducted, after the approval of the proposal, according to this schedule:

- From October 24 to November 8, 1998: Martín Mujica visited Lima in order to organize the work with Etienne Durt and to help him to get data and information relevant to the evaluation.
- From November 23 to November 27, 1998: Martín Mujica conducted interviews in Santiago, Chile.
- From December 14 to December 19, 1998: Etienne Durt visited Cusco, Puno and Arequipa. The purposes of the visit were to establish local collaboration to the evaluation and to get a first collection of documents. The targets were professionals working at the universities, ONG and government institutions.
- From January 4 to January 9, 1999: Etienne Durt and Martín Mujica visited La Paz and Cochabamba. Data collection of Bolivian projects.
- From January 15 to January 21, 1999: Etienne Durt visited Ayacucho on Jan, 15-16, in order to organize the field work in that region. Then, he proceeded to Cusco, Arequipa and Puno for interviews and data collection.
- From January 29 to February 17, 1999: Martín Mujica visited Peru for field work in Lima (work with Etienne Durt), Cusco (two focus groups, visit to the university and Colegio Andino, field visit to Písac area) and Arequipa (one focus group and visits to DESCO-Arequipa, ZVIECOR and IDEMA). Edward J. Weber arrived to Lima on Feb. 7, and then from Feb. 8 to Feb. 12, with Martín Mujica, they worked together with Etienne Durt and participated to a focus group in Lima.
- From March 23 to April 2, 1999: Etienne Durt visited Arequipa, Puno and Cusco for fieldwork on data collection and interviews.
- From April 9 to April 25, 1999: Martín Mujica visited Peru to work in Lima with Etienne Durt. Then on Apr. 16-17, they visited Ayacucho in order to participate in a focus group and visit the university and a local project. Edward J. Weber arrived to Lima on Apr. 18 and from Apr. 19 to Apr. 23, the two evaluators and the local consultant worked together and participated at a focus group.
- From July 12 to July 23, 1999: Martín Mujica visited Lima, to work with Etienne Durt on the final report and to conduct interviews.

Annex 5: Crops and Livestock Mentioned in the Text

It is worthwhile indicating which crops and livestock were integrated into the production system projects. Based on in various project reports and research papers the following tables list the main products but do not indicate their relative importance.

Table 8: Principal Andean Products

Common name	Scientífic name
Arracacha	Arracacia xanthorrhiza
Camote	Ipomea batata
Kañihua	Chenonopodium pallidicaule
Kiwicha	Amaranthus caudatus
Mashua	Tropæulum tuberosum
Oca	Oxalis tuberosa
Olluco	Ullucus tuberosus
Papa	Solanum andigenum
Papa amarga[16]	Solanum jizepczukii
Quinua	Chenopodium quinoa
Tarwi	Lupinus mutabilis

Table 9: Important Non-indigenous Crops in the region

Common name	Scientífic name
Cebada	Hordeum vulgare
Frijol	Phaseolus vulgaris
Maíz	Zea mays
Pallar	Phaseolus lunatus
Trigo	Triticum æstivum
Zapallo	Cucurbita maxima

[16] A type of potato that is cultivated in very high agroecological zones (3800-4200 masl). After a freeze drying process that eliminates the bitter flavour, derived products (starch) can be obtained. (Rivera Romero 1993)

Table 10: Principal Andean Livestock

Common name	Scientíific name
Alpaca	Lama pacos
Cuy	Cavia porcelus
Llama	Lama glama

Annex 6: Training and Thesis in PISCA and PISA

At the professional level

In PISCA, a familiarization course on systems approaches, in CATIE, Costa Rica (1980), for the three project coordinators from Ayacucho, Cusco and Puno.

In PISA, a specialization course on production systems for Oscar Arroyo of INIA, in CATIE.

At the post graduate degree level

- Doctorado en fitomejoramiento, Angel Mujica, del INIA, Universidad de Chapingo, México
- Maestría en Economía Agrícola, Edwin Zúñiga, Universidad de Chapingo
- Maestría en Sistemas y Desarrollo Rural,. Roberto Valdivia, de la Universidad Nacional del Altiplano, de Puno, en el CATIE, Costa Rica.
- Maestría en Producción ganadera,. Luis Abarca, del INIA en la Universidad de Chapingo, México.
- Maestría en Sistemas de Producción,. F. Cahuana del INIA, en el CATIE.
- Maestría en Producción Agrícola en la Universidad Nacional Agraria de La Molina, L. Ponce, del INIA.

At the undergraduate level

The following persons received PISCA project support for their degree thesis preparation.

In Cusco

Daza, B. y Navarro, T. 1981. Estudio agrológico detallado de las comunidades de Amaru, Paru Paru, Sacaca y Cuyo Grande.

Farfán, F. 1981. Soportabilidad pecuaria de los pastos naturales de las comunidades de Amaru, Paru Paru, Sacaca y Cuyo Grande.

Huamán, M. 1981. Incidencia del Distoma hepático en bovinos de la comunidad de Cuyo Grande, Cusco.

Esenarro, Graciela. 1983. Características ecológicas de la agricultura nativa en la comunidad de Pampallacta, Cusco.

Maldonado, A. y Hurtado T. 1983. Construcción de una planta experimental de biogás a partir de desechos orgánicos de la Granja Kayra.

Mamani, E. 1983. Época y densidades de siembra en tres variedades de quinua.

Stevens, Elisa. 1983. Evaluaciones nutricionales sobre las dietas familiares en las comunidades de Pisac.

Koster, W. y Schweren, H. 1983. Evaluación económica de la producción agrícola en cuatro comunidades en la sierra del Cusco. (Universidad de Wageningen).

Soto, V. 1984. Estudio del rendimiento en principios nutritivos de doce variedades de quinua.

Díaz, J. 1985. Uso de las malezas y subproductos agrícolas en la alimentación del ganado en las comunidades campesinas de Amaru, Sacaca, Paru Paru y Cuyo Grande.

Rodríguez, I. 1985. Efecto de la altitud sobre el grado de ataque de antracnosis en ocho líneas seleccionadas de tarwi.

Sotomayor, M. 1985. Diagnóstico técnico agropecuario de las comunidades de Amaru, Sacaca, Paru Paru y Cuyo Grande.

In Puno

Arpita, T. 1982. Ensayo comparativo de cultivos asociados en la comunidad de Luquina Grande.

Arenas, 1981. Tres formas de preparación del suelo en dos variedades de papa. Puno.

Bellido, L. 1981. Actividad pecuaria tradicional en tres comunidades del altiplano.

Bolaños, G. 1982. Costos de producción de papa en comunidades campesinas.

Colque, N. 1982. Comparativo de cuatro cultivares de quinua en tres sectores de la comunidad de Luquina Grande.

Huallpa, E. 1981. Ensayo comparativo de tubérculos andinos en forma intercalada en la comunidad de Luquina Grande.

Huapaya, F. 1983. Etnofitopatología en comunidades aymaras de las riberas del lago Titicaca.

Loayza, D. 1983. Evaluación parasitaria en ovinos de las comunidades de Camacani y Luquina Grande.

Lopez, B. 1984. Tecnología agrícola tradicional en el altiplano peruano.

Manrique, L. 1983. Comparativo de cuatro cultivares de haba (*Vicia faba*) en dos comunidades de Puno.

Ramos, P. 1984. Efecto de la rotación de cultivos andinos (tercer año).

Soto, W. 1982. Ensayo comparativo de cuatro variedades de cebada en la comunidad de Luquina Grande.

Uribe, S. 1983. Comparativo de 16 líneas de alto rendimiento del banco de germoplasma de quinua. Puno.

Zevallos, J. 1985. Secuencia de rotación de cultivos andinos (cuatro años). Puno.

In Ayacucho

Porta, E. 1983. Tecnología agrícola tradicional y sistemas de producción de cultivos en la comunidad campesina de Arizona.

Salvatierra, M. 1983. Influencia de seis épocas de siembra en variedades de papas nativas.

Sulca, A. 1983. Comparativo de rendimiento de cuatro variedades de cebada en dos comunidades campesinas altoandinas.

In Ayacucho, most experiments in communities were conducted directly by project staff.

In Arequipa.

McCamant, Kris Ann. 1987. La organización de la producción agrícola en Coporaque. Universidad de California, Berkeley, USA.

In addition, the following theses were completed with PISA project support:

Góngora, Gleny, 1989. La mujer campesina en los programas de desarrollo rural. Facultad de Antropología, Universidad Nacional San Agustín, Arequipa.

Angles, Florencio, 1987. Sistema tecnológico andino en qochas y organización campesina. Fac. Ciencias Sociales, UNTA, Puno.

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Agramonte Villa, M. (1987). Incremento de peso corporal de crías y ritmo de crecimiento de la fibra de alpaca en dos sistemas de producción. Facultad de Agronomía y Zootecnia. Cusco, Universidad Nacional San Antonio Abad.

Alfaro, A. (1993). El desarrollo rural y los sistemas de producción andina para la formulación de proyectos agrarios: Manual de planificación agrícola. Cusco, Universidad Nacional San Antonio Abad.

Arroyo, O. (1986). Avances de investigación sobre cuyes en el Perú. Puno, Proyecto de Investigación de Sistemas Agropecuarios Andinos (PISA).

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Conforte, D. (1997). Evolución reciente y perspectivas de la producción, procesamiento y comercialización de quinua en Bolivia, Perú y Ecuador. Montevideo, Centro Internacional de Investigaciones para el Desarrrollo**:** 24.

Consorcio para el Desarrollo Sostenible de la Ecorregión Andina (1998). Raíces y tubérculos andinos: Informe sobre la colaboración en investigaciones de biodiversidad, 1993-1997. Lima, Centro Internacional de la Papa.

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Ortiz Rojas, S. A. (1988). Evaluación de algunos métodos de control de la mortalidad en crías de alpaca (*lama pacos*) en explotaciones familiares. Facultad de Medicina Veterinaria. Lima, Universidad Nacional Mayor de San Marcos.

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